THE
ETHERIC FORMATIVE FORCES
IN
COSMOS, EARTH AND MAN

A Path of Investigation into the World of the Living

by

DR. GUENTHER WACHSMUTH

Translated from the second German Edition by
OLIN D. WANNAMAKER, NEW YORK

VOL. I

1932
ANTHROPOSOPHICAL PUBLISHING CO.
LONDON

ANTHROPOSOPHIC PRESS
NEW YORK

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GERMAN EDITION
Die Ätherischen Bildekräfte
in
Kosmos, Erde und Mensch.
Ein Weg zur Erforschung des Lebendigen
2.Aufl.
Philosophisch-anthroposophischer Verlag am Goetheanum
Dornach (Schweiz).

ITALIAN
Le forze plasmatrici eteriche nel cosmo, nella terra e nell' uomo
Una via alla ricerca di ciò che è vivante.
Casa Editrice " Atenòr " di Todi, Succursale di Roma.

Editions in Russian, Swedish, French, etc., in preparation.

Made and Printed in Great Britain by
LAWRENCE BROS. (Weston-super-Mare), Ltd.,
North Street, Weston-super-Mare, Som.

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The astronomer Johann Kepler, in his work "Harmonices Mundi," "The Harmonies of the Spheres":

"Even though men may scorn me for my frank confession—*Yes! I have stolen the sacred vessels of the Egyptians that I might make of them a sanctuary for my God, far, far from the confines of Egypt.*

"If ye forgive me, I shall be happy; if ye are angry, then I must bear it. Well, here I cast the die and write a book—whether for the present or for the future is of no consequence to me. What though it wait a hundred years for its reader—God has awaited his decipherer for thousands of years."

Foreword to the First German Edition

A BOOK concerned with problems of natural science will, in our day more than ever before, grow into a treatise upon the most profound questions of philosophy, if it is to deal adequately with its problem. For in this materialistic age the results of scientific research, not only in their power to illuminate but also in their power to darken, have penetrated so deeply into the human mind, into its habits of thought, that corresponding effects show themselves even in the outward and visible life of our age—although the true cause of these conditions is not any longer present to the consciousness of most of those who are themselves involved in the sort of life thus manifested. But the new generation now growing up sets itself, with the energy of those who are battling for their lives, against being swept into this current of our age, a current whose chaotic, ruinous nature is to be explained wholly as a result of the scientific thought of the past century, but especially of the last decades.

Who is not deeply impressed to-day with the feeling that those ideas taken over from the scientific conceptions of the past century, and then popularized and introduced into the thought and activities of every-day life—conceptions of " the struggle for existence," of " natural selection," of the pitiless " mechanism of Nature," of the " survival of the fittest " and the annihilation of all that fails to meet the requirements of this supposedly utilitarian Nature—who does not feel that all these conceptions, ostensibly learned from Nature herself but really obtruded upon her out of one-sided and limited human thought, have brought a terrible devastation into the minds of men, and that this spiritual confusion has been the impelling factor in bringing about the European catastrophe ? This is not a question of guilt or innocence. It is a question as to the manner in which a spiritual stream in human evolution which took its rise in the fifteenth century, and reached its culmination at the turning point between the nineteenth and the twentieth, is drawing to its end. This spiritual stream, which—when viewed in its brighter aspect—has brought to us the great scientific revelations, yet also has given to the men of our time a phantom picture of the world wherein this cosmic system, in which we must live, appears as a great corpse. For the scientific research of these 500 years—however great the service it has conferred upon human nature in the direction of the understanding and domination of dead " matter "—has, on the other hand, failed to lift ever so little that veil which conceals true knowledge and the mastery of that which is alive. Indeed, a future age, viewing more impartially this trend of human inquiry, will be able to show that the development of natural science in the direction of an understanding of what is dead has fastened a leaden weight upon man's feet to hinder him from moving toward a knowledge of what is living—a weight from which he will be able to free himself only by an almost superhuman effort.

Wherever one engages in conversation to-day in any part of the world, especially with young men, one becomes aware of that great process of fermentation through which the coming generation will free itself of the horrible form to which our conception of the world, and thus also our life, has been reduced by a materialistic science, directed almost wholly towards merely quantitative results. It is for men of this sort, who wish to cast from their feet the leaden weight, that this book has been written, in the hope that it may give to them the elements out of which to build up a new and different conception of the world, a conception in which the investigation of the living, the organic, as the true origin and starting point for knowledge—with the inorganic and lifeless constituting the less essential part of the world-conception within this framework of the living—will be the object of our study.

Of the reader of this book I would beg that, before he begins, he will spend five minutes in bringing before his mind's eye, in thoughtful reflection, the present world situation, unmitigated, in all its future perspective. He will then enter upon his co-operation in the problems to be attacked with his mind equipped otherwise than one who is interested merely in adding to his treasury of formulæ one formula more, or one who works in the merely scientific fashion to protect from disturbance a pet theory which has become necessary to his comfort. The method of research applied in this book and the results of this method must be taken as a whole, as a unity. Whoever extracts any detail whatever from the book in order to play that game of concepts so beloved by the abstract intellectualism of our age, instead of fixing his view upon the whole, will simply be attempting to run his head against a wall that does not exist.

We do not propose merely to pass over in a schematic fashion from the results of the investigations of the lifeless to investigation of the organic, the phenomena of life, the living; on the contrary, we propose to unite a new sort of view of the world with a new inner mood of spirit, which ought to penetrate us and remain with us from the beginning in the scientific investigation of both the living and the lifeless. *Here there is no great gulf in man separating religion and science, such as has been artificially created by the merely quantitative-mechanical tendency in science.* Whoever reads this book with an open and unprejudiced mind will find, nevertheless, that the vast results of the previous investigations in the same field are used as its foundation and serve as its tools. But this is to be the chief distinction of what we shall strive to accomplish: that, although the coming generation dare not, cannot, and will not set aside the results of the quantitative idea of the world and begin anew to work without these, but will weave the already attained results of quantitative research into their new conception of the world, where these are very valuable supports for knowledge, yet they will, on the contrary, reject these, especially in their own attitude of mind, wherever their effect is to degrade our cosmos into a corpse.

Everything contained in the following pages owes its origin to the fact that the author is an adherent of Spiritual Science as given its determinative direction by Anthroposophy. Whatever is false or imperfect in the book is the fault of the author and not of the theory. I am well aware that the volume is only the first feeble endeavour to master the problems attacked. Many slips, many failures in clarity, have doubtless crept into this attempt to survey by a new method such varied and complex fields of human knowledge. Yet a conviction as to the rightness of this new way of viewing the problems and of the urgent necessity for such a view has given me the courage to risk the attempt. Whoever has blazed a trail in a hitherto unknown region will know that, in such a journey of exploration, no one can at first take the most direct or the easiest path to his goal. Yet only a man of small nature will come to grief because of the roughness of the path, right in itself; a man of spirit will take pleasure in the new trail, and will himself lend a hand in order that the new goal may be reached.

As a small portion of that comprehensive contribution which Anthroposophy will make toward the evolution of humanity, this book is dedicated, from the author's profound sense of an inner necessity, and in spite of his consciousness of its imperfections, to him who has called Anthroposophy into being—Dr. Rudolf Steiner.

Heartfelt thanks are due also to many others, all of whom I would gladly mention by name, but especially to Mr. Scott Pyle, of New York, to Count Otto von Lerchenfeld-Köfering, to Frau Harriet von Vacano—who has translated into German for us the great christian philosopher Vladimir Solovjeff—and to my brother, Wolfgang Wachsmuth, as well as Dr. Ita Wegman, all of whom have given both counsel and co-operation. For scientific and experimental collaboration, there is a special debt to Herr Ehrenfried Pfeiffer. To the many others who have aided may the most earnest thanks live in my thought.

GUENTHER WACHSMUTH.

The Goetheanum,
Dornach, near Basel, Switzerland.
1923.

Foreword to the Second German Edition

WHOEVER has followed with watchful attention the course of world history and the evolution of consciousness during the last three years, and especially during the past year, in their tumultuous effects on the several continents, will understand why an additional point of view must be expressed on the occasion of the second edition of this book for which there was no pressing occasion as regards the first edition. This is the point of view based upon consideration of the coming adjustment between Occident and Orient. The glaring light of this future event is already cast upon international conferences, press despatches, modes of thought, and the events of our daily life.

In the endeavour to set forth a natural-scientific conception of the world on the basis of Spiritual Science, as we seek to do in the following pages, it is inevitable that a certain point of view must from the first be a determining factor. Whoever wishes at this moment of time to depict a conception of the world with which we men of the twentieth century may really *live* must not understand by the term *man* only the Occidental, nor only the Oriental. In every mention of Occident and Orient which here follows, we are not concerned, of course, with a higher or lower evaluation of the one or the other, but solely with factual conditions with which one must reckon. It is by no means a matter of prime importance nowadays merely to increase the natural-scientific knowledge of a group of men by adding to that knowledge a certain number of items. The essential point of our task lies far more concretely in the choice of a method of presentation which will be equally intelligible to the scientifically educated men of the Occident and to the Oriental, schooled in a wisdom coming for thousands of years from a wholly different source. Indeed, the method must be such, furthermore, that the two human types may be brought to a common *basis of discussion*. It is ominously clear, from many utterances of leading personalities in each group, that at present these fail to meet one another in any of the essential points of thought, feeling, and will. Since the same words, and even seemingly identical concepts at the back of these words, have utterly dissimilar contents in the minds of the two groups of men, there seems to be no hope for a basis of discussion—as, indeed, both sides admit. Therein lies a world peril. The wisdom of the West, built upon natural science, and the wisdom dominant for thousands of years in the Orient contain concepts so unlike in meaning that the approaches attempted reciprocally during recent decades with all mutual good-will have only made the difficulties greater than ever, since we have thereby for the first time brought into conscious realization the almost unbridgeable gulf between the two groups.

Whoever, therefore, does not wish merely to increase Occidental natural science and export this to the Orient, nor merely to transplant the Eastern conception of the world to an Occident quite unadapted for its reception,—such a person faces the task of discovering, first of all, a form of expression and a nomenclature intelligible to both sides in which to discuss Nature and the forces at work in Nature. For the helping forward of the Occident alone or of the Orient alone no longer signifies helping forward humanity as a whole ; it signifies rather the strengthening of the opposition between East and West, and is therefore working toward the ruin of humanity.

It is a duty, therefore, to point out that in the following pages an effort had to be ventured upon—in accordance with a quite definite suggestion of Dr. Rudolf Steiner—to present certain phenomena drawn from our knowledge of Nature in such a way that these might be discussed at one and the same time with both Occidentals and Orientals. The "Western key" to this forum of discussion was expected to be furnished by the knowledge derived from modern natural science ; and the "Eastern key" by that derived from certain parts of the primal wisdom of the Orient, which arose by the Indian cradle of human evolution and left its impression, often greatly falsified, in the Sanskrit texts and the Vedanta and Yoga philosophies, as well as their derivative cultures. This is to be, then, not a struggle between mutually hostile concepts, but the search for a new synthesis. Two different keys are to throw open the same realm of knowledge. What is to be attempted, therefore, is to be a twofold work of translation,—on the one hand, a translation of the mechanistic science of the Occident, seemingly contradictory of the fundamental religious conceptions of the whole human race, into such a mode of presentation as opens again the doors to the realm of the spiritual and of religion ; on the other hand, a translation of the Oriental teaching of the world-building forces, given mostly in pictures and in the forms of dialogues, into such a form of expression as will render possible its application to the mastery of matter. It is in this latter work that the Occident, in spite of its giving a secondary place to the religious element, has achieved so much. The West has employed its knowledge of world-laws primarily, indeed, for the mastery of force and substance in the external world ; the Orient has used its knowledge of world-laws primarily for personal spiritual discipline. The result of a Western knowledge of Nature leads mainly to the construction of some sort of machine. The result of Eastern knowledge of Nature was clothed in the utterances of a god or a teacher to his disciples for the purposes of purely spiritual practises. But each human group needs both these results. And the world-laws are certainly, in the last analysis, the same for both. If, then, students of the ideas of Newton, Laplace, Helmholtz, Hertz, Einstein, and others and the students of the teachings set down in Oriental philosophy concerning the forces of Nature* should place their concepts and nomenclature within the conception of the world here presented, both would be brought to the same orientation of thought regarding the forces that build and move the universe—an orientation of thought doing justice to the conceptual systems of both groups.

To many persons this may seem at present absurd or far-fetched. But the attentive observer of the present world status will strive to follow this path as the sole way of salvation for the coming decades. To strive toward a goal does not mean that one has reached it ; but it has now become a matter of duty to move in that direction. We do not here address that sort of stay-at-home among scholars and scientists who believes he can ignore the problem of Orient and Occident because his laboratory is some thousands of miles from Asia or from America, or else because this problem lies outside his special province. World history in its onward march will not respect the seclusion of such scholars' studies.

But whoever looks upon scientific research, not as a thing good in itself, but as a task which must from time to time be adjusted to changes in world history, must to-day at least endeavour to speak of the idea of the world in such a way that a *common basis of discussion* may thereby come into existence for both Occidental and Oriental.

In order to preclude misunderstanding, we must caution the reader that what has just been said applies solely to the method of presentation of the formative forces and cannot affect in the least the facts themselves, or the content of the knowledge in itself. The content of what is to be said regarding these forces and their activity is the result of objective natural-scientific research, and as such is unrelated to the problem of Orient and Occident. Since, however, any knowledge possesses true value for men to-day—that is, value for man's life—only when representatives of both human groups understand it and can apply it in the practice of life, we must seek to set forth the objective nature of the world in such a way that access to this is open to both groups, and its doors may be unlocked by both with their own keys.

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* See Guenther Schubert : " Indische Bezeichnungen für die Ätherarten " (" Indian Designations for the Kinds of Ether "). Gäa-Sophia, Yearbook of the Natural Science Section at the Goetheanum, 1926.

That the East needs to learn much more of the Occidental mastery over matter and the mechanical, in order to keep pace with human evolution, is obvious and will be admitted freely by Oriental intellectual leaders. What now repels the Orient is the absence of any bridge in the Occident between religion and science; it is the soul-desolating character of the conceptual system of the West. In the West, scientific research in the deeper nature of living organisms and of processes of soul and mind has had much to say, very honestly, through the persons of its best and most exact experts, regarding the impossibility of crossing the present boundaries of knowledge by means of the methods developed during recent decades. Indeed, not only as regards life-processes, but even regarding phenomena in Nature that are to be conceived in a purely physical sense, the merely seeming surety of knowledge of the nineteenth century has become a dangerously growing insecurity of knowledge. Such is the statement of one of the best informed and most nobly upright physicists of our time, Professor Max Planck.* "We have seen," writes Professor Planck, "how physics, which might have been considered a generation ago one of the oldest and maturest of the natural sciences, has now entered upon a period of storm and stress which promises to be its most interesting period up to the present. Its mastery will lead us, not only to additional discoveries of new phenomena in Nature, but assuredly also to quite new insights into the secrets of the theory of knowledge. In the latter field there may still await us many surprises; and it may well happen that in this process certain ancient conceptions now condemned to oblivion will come to life again and begin to take on a new significance."

But the sole thing which the West lacks, in order to penetrate in exact natural-scientific research into all that pertains to the living organism and the soul and spirit, appears most clearly, perhaps, in the following words of Dr. Rudolf Steiner, quoted from his autobiography:† "What was lacking in those who strove to go beyond the mechanistic interpretation of the world was primarily the courage to say to themselves that one who would surmount this mechanism must surmount also the habits of thought which have brought him to this. A confession demanded by the times failed to appear. It is this: that, by taking the direction of the senses, man penetrates into that which is mechanistic. In the second half of the nineteenth century, this orientation had become habitual. Now that the mechanistic has failed to satisfy, one should not seek through the same orientation of attention to penetrate into the higher spheres. The senses in man evolve of themselves. But he will never perceive through what they bestow upon him anything other than the mechanical. If he wills to know more, then he must, *from within himself,* give to the deeper-lying powers of knowledge a form such as Nature gives to the senses. *The powers of knowledge for the mechanical are awake of themselves ; those for the higher forms of reality must be awakened.*"

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* See "Naturwissenschaften," March 26, 1926, p. 260.

† "The Story of My Life." London, 1928.

Certainly we must not and cannot strengthen the powers of thought in the West by using the methods of the East. All such efforts are entirely alien to reality and positively harmful. But the exact methods given by Dr. Steiner, out of the realm of ideas of the West and for the man of the West, for the awakening of " the powers of cognition for the higher forms of reality " are those required by the West if it is not to be forced to pause still longer in the progress of knowledge before the phenomena of life.

In response to many communications received after the appearance of the first edition of this book, I would here refer only by way of general principles to certain of the criticisms and questions—since the positive communications have already led to further labour on my part. It has been asked, for instance, why certain fields of study have been touched only in a brief and sketchy manner while others were more thoroughly discussed. In reply it must be said that we could by no means undertake an encyclopædia of the etheric. Many heads and many decades would be required for this. One cherishes the earnest hope that coming generations till the end of the twentieth century may elaborate such an encyclopædia of the etheric for the benefit of humanity. All that was proposed in this book may, perhaps, be made clear by the use of the simile above :—The theory of the etheric was to be made a *passe-partout,* master key to the knowledge of Nature ; so that the matter of primary importance was to demonstrate through as many random instances as possible in various fields that this theory does prove to be everywhere—if rightly used—the key that unlocks. Far less important was the question as to which door one first tests the key upon. But the greater the number of instances in which the application is made in future through collaborative effort, the more beautiful and complete will be the conception of the world thus wrought out.

In connection with this second edition I desire to express my very special thanks to Dr. H. von Dechend, as well as Dr. A. Usteri, who have given me most helpful suggestions. Many other helpers also I remember with heartfelt thanks.

In this second edition the theory of ether has not been altered at all in principle, after mature testing, but much has been modified in the endeavour to elaborate the illustrative material more clearly in its manner of expression or through amplification. Here also I would once more caution the reader that I am deeply aware of the incompleteness of this undertaking. Yet my experiences since the appearance of the first edition have only confirmed my courage to go ahead on the same road.

We feel that we have been called by a word of Goethe's to a beautiful and sacred task, and that we are obliged to undertake it :—

MANIFESTO

You'd study Nature ? Then remember
One and All must go together.
Naught is in and naught without,
For what's within is still without.
Hasten man, look up, behold
Her open mysteries unfold !

True her seeming, real her play ;
Rejoice in them and her.
No living thing is one, I say,
Its many, everywhere.

(From Goethe's "Sprüche.")
Translated by Miss F. M. Stawell.

GUENTHER WACHSMUTH.

The Goetheanum,
Dornach, near Basel, Switzerland.
1926.

Introduction

THE modern scientific conception of the world seeks to reduce the endless diversity of all natural phenomena to two fundamental ideas, two concepts lying at the foundation of all things : matter and ether. But the conceptions held by the most advanced investigators in regard to these two ultimate basic units are so wide apart that the time is certainly already at hand when the whole structure of theory reared upon these two debatable basic concepts is trembling to its fall. The time has come, therefore, when the knowledge which spiritual science has attained of ether and its activities in Nature may be introduced into discussion without the expectation that one must encounter insurmountable obstacles due to a certain dogmatism which has, unfortunately, arisen to some extent among scientists during the last half-century.

The distinguished investigator of ether, P. Lenard, says in his well-known lecture " Über Äther und Materie," delivered before the Heidelberg Academy of Sciences,* that, if a scientist of our age is asked how the world appears according to his conception, he must answer thus : " In expressing himself on this subject, he must first make it clear that what he has to say deals only with that part of the world which *is accessible to quantitative research through the help of our physical senses.*† It is just here, in this quantitative characteristic, the possibility of comparing all results quantitatively with the reality and thus testing them, that physical science differs from the mental sciences, which deal primarily with the other part of the world. That part of the world which lends itself to quantitative research by means of the physical senses we may call also the material world. It is only with this that the scientist has to do ; it is of this that he has formed an idea " (p. 5). One must certainly examine critically this tendency in the scientific mode of conception of the past century if one would reach a fruitful view regarding the nature of ether and matter, and if one wishes to know why, under the self-imposed limitations of this tendency in scientific research—that is, the restriction of research to (1) the merely quantitative, and (2) the merely sensually perceptible—we can never arrive at a satisfactory understanding of ether. The obvious reason for this lies in the facts that (1) ether has not only quantitative but also qualitative characteristics, the latter of which can by no means be separated from the former—that is, supersensible, spiritual characteristics in reference to which the cognition of the merely quantitative inter-relation of the assemblage of facts is wholly inadequate ; (2) that ether is not perceptible to our physical senses. Clearly, then, one who limits himself to the quantitative and the sensually perceptible can never arrive at a true view of the nature and the action of ether.

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* Heidelberg, 1911.

† All italics throughout are Dr. Wachsmuth's.

Lenard says that the ideas held by natural scientists in our time are of two kinds :—" Quantitative they are always. But they may be restricted—and this gives us the first kind—wholly to quantitative relations among observable magnitudes. In this case they can be expressed completely in mathematical formulæ, chiefly in differential equations. This is the form preferred by Kirchhoff and Helmholtz, and called by Kirchhoff the mathematical description of Nature. Examples of such conceptions are Newton's law of gravitation and Maxwell's equations in electro-dynamics. The logically inevitable conclusions based upon these ideas—and in the development of these conclusions lie both the use and also the test of the ideas—are, therefore, simply the mathematical inferences from these equations and nothing more. But one may proceed further—and this gives us the second kind of ideas—in that one may permit oneself to be guided from the first by a conviction—without which, indeed, the investigation of Nature would never have come to any issue—that is, the conviction that all phenomena in Nature—at least, in inanimate Nature—are simply phenomena of motion : that is, they consist merely in changes of position on the part of substance given once for all. Then we should have in each case a question of mechanisms, and the equations which we reached as our first sort of ideas must be *equations in mechanics*, must correspond to certain quite definite mechanisms, so that *we may actually consider these mechanisms as the ideas which we have formed of the phenomena of Nature. Then the ideas of things that we hold in our minds are modelled upon mechanics and dynamics.*"* By way of resumé, Lenard adds : " All that occurs in the world is motion, change in position on the part of substance given once for all. There is not the slightest sign of a first appearance or of a disappearance of substance. Therefore, what remains to be done in the matter is only to state of what kind the substance is, how it is distributed in space, and the nature of its motions ; and here we must first make the fundamental assertion that the substance which is in motion, out of which we see the entire world come into existence, is of two kinds, matter and ether."* Later, when he has introduced into this conception of the world the most recent investigations in radio-activity, he defines the world as consisting, not of matter and ether, but of ether and electricity. And yet even Lenard is forced to say : " The question is simply this : whether it is possible for us in this way to form a correct image of reality ; or whether the human mind is at all capable of forming within itself an image of the whole of Nature—or even of inanimate Nature. As to this, there is nowadays the most serious doubt. . . ."† He concludes with these words : " I do not believe that the difficulties can hinder us from cultivating and developing still further our present conception ; for, in that event, we should have abandoned entirely any such conception, and therewith the possibility of conceiving of Nature at all in terms of mechanics. I believe that this will not occur, even though, in order to clarify our conception of the mechanics of ether, we should have to posit beside or behind this ether and its parts still another ether."‡ In these words the openly confessed *ignorabimus* of a Du Bois Reymond is evaded only by means of the hope that some way out will be discovered. But such a hope can never be realized through a process whereby one seeks to save a purely mechanical interpretation of the world by inventing more and more theoretical new kinds of ether. In his conflict with the theory of Einstein, which would deprive the ether of every mechanical property, Lenard has now already introduced, beside the ether, a still prior ether in order to rescue his conception of the world. But these are steps upon a road which will in future prove more and more a mere blind alley.

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* *loc. cit.* p. 5.

The comprehensive thinker and investigator Karl Christian Planck took in his day a bold stand against the merely mechanical explanation of such entities as heat, light, weight. He sought to combat the distinction between quantitative and qualitative attributes of the material world, which arose in the scientific thought of the last century, and to show that, because of this arbitrary distinction, a scientific conception of the world has been built up in which the action of something spiritual within the so-called material world can no longer be explained, and the origin, the genesis, of the world of substance out of that which existed before the " primal nebula " becomes quite unintelligible.

In his " Testament eines Deutschen " § Planck says : " And just as happens in the relationships of gravity, so also the relationship of bodies to heat and light is completely reversed by that mechanical theory. . . .

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* *loc. cit.* p. 7. † *loc. cit.* p. 7. ‡ *loc. cit.* p. 51.

§ Jena, 1881. 2nd Edition, 1912.

According to this theory, the atoms of matter have in themselves nothing whatever to do either with heat or with light ; they are conceived as being, in their own nature, parts existing wholly for themselves, which only in their mechanical relations of motion to other atoms give rise to light and heat. Thus is the true and basic relationship of Nature and her general law of evolution completely reversed, in that those forms which, according to the actual appearance, are the undifferentiated and universal—concentration, or gravity, and its exact counterparts, heat and light—are not to be considered as the original elements, but on the contrary the independently individual and differentiated atoms of matter are thought of as the pre-supposition pre-requisite to gravity, heat, and light. In spite of the fact that the present view of Nature is forced to admit that the state of the heavenly bodies evolved first out of the condition of uniform and undifferentiated heat and light into a state of the variously separated and individual, yet in the last analysis the first place is none the less assigned, not to the simple and undifferentiated unity with the whole (heat, etc.), but to the separate and individual parts (atoms). That law of evolution which is supposed to hold good for all of Nature and especially for all development of organisms, is turned upside down, and thereby, as we shall see, all explanation of the organic, of the physical, and of the spiritually universal, is rendered impossible, since from the start the mechanical separateness of the separate atoms, the independence of partial existences, is made the primal thing."

Planck therefore warns against the error of making the world of atoms genetically prior to the world of the entities heat, light, etc., and against adopting at the outset a view as to the investigation of Nature which must restrict the knowledge of Nature within limits ever more and more narrow.

In the midst of all the doubts which now beset the greatest natural-scientists as to the manner of viewing the world which they have hitherto maintained, it is impossible to understand why the orientation of research which Dr. Rudolf Steiner initiated in his scientific writings, and which furnishes a means whereby we may be guided out of this dilemma, has not yet been adopted. As early as 1888, Dr. Steiner pointed out in those writings of his the false path taken in such a manner of viewing the world as that of Du Bois Reymond, which resolves the processes of Nature into mere " mechanics of atoms," or that of Ostwald, who reduced them all to the mere " manifestation of energy." Steiner then wrote* :

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* Dr. R. Steiner, " Einleitung zu Goethes Naturwissenschaftlichen Schriften," Deutsche Nationalliteratur, Stuttgart. Reprinted as " Goethes Naturwissenschaftliche Schriften," Dornach, 1926. This work will be indicated in subsequent references by the initials E.G.N.S.

"This is what Du Bois Reymond finds: 'It is a psychological fact of experience that, when such a solution (the resolution of the processes of Nature into the mechanics of atoms) comes to us, our inner need for a causal explanation is provisionally satisfied.' This may be a fact of experience for Du Bois Reymond, but it is necessary to say to the gentleman that there are other men who have no sense of satisfaction whatever in a crass explanation of the corporeal world—such as he conceives it."*

It is the epoch-making achievement of Steiner to have pointed out—in contrast with all preceding views of Nature—that the previous division of the conception of the world into an objective part, which can be grasped only in a mathematical-mechanical fashion, and a subjective part, as this division has been made, has led to a complete distortion and falsification of this conception of the world. The reflections of the more recent philosophers and scientists, he declares, "have led to the belief that the external phenomena which produce sound in the ear, light in the eye, and heat in the organ of heat-perception have nothing in common with the experience of sound, light, heat, etc. On the contrary, these external phenomena are supposed to be certain motions of matter. So, then, the scientist seeks to discover what sorts of external motion-phenomena cause sound, light, heat, etc. to arise in the human soul. He comes to the conclusion that, outside of the human organism, there exists nowhere in all space such a thing as red, yellow, or blue, but that there is only a vibratory motion of a fine elastic medium, the ether, which, when experienced by the eye, manifests itself as red, yellow, or blue. The modern natural-scientist thinks that, were there no experiencing eye, neither would there be any colour, but only ether in motion. The ether, he thinks, is something objective; the colour, merely something subjective produced in the human body."†

In opposition to this, Dr. Steiner maintains the following: "Any one whose capacity to think has not been entirely destroyed by Descartes, Locke, Kant and the modern physiology will never be able to conceive how one can consider light, colour, tone, heat as merely subjective states of the human organism and yet continue to maintain the existence of an objective world of phenomena outside the organism. Whoever makes the human organism the creator of the occurrences known as tone, heat, colour, etc., must also consider the organism as the producer of extension, mass, position, motion, forces, etc. For these mathematical and mechanical qualities are inseparably united with the other contents of the world of experience. The separation of the relationships of space, number, motion, as well as the manifestations of energy, from heat, tone, light, and other sensible qualities is purely a function of abstract thought."* "Therein lies the one-sidedness. A line is drawn through the midst of what is perceptible to the senses, and one part is explained as objective and the other as subjective. There is but one logical conclusion :—If there are atoms, these are simply parts of matter with the characteristics of matter, and imperceptible to our senses only because of their smallness. But, then, there ceases to be any possibility that we should find in the motion of the atoms something objective to set over against the subjective qualities of colour, tone, etc. And there ceases also to be the possibility of finding in the relationship between the motion and the sensation of red, for example, anything more than between two processes which belong wholly to the sense-world. It is, therefore, obvious that motion of ether, position of atoms, etc., belong on the same plane with sensations themselves. To explain the latter as subjective is only the result of faulty reflection. If we explain the sensible quality as subjective, we must do the same with the movement of the ether. *We fail to perceive the latter, not by reason of any principle, but only because our organs of perception are not organised delicately enough. But this is a mere chance circumstance. Humanity might conceivably arrive, through the refining of its sensibilities, at a point where movements of ether would be directly perceptible. If, then, a man of that remote future should hold our subjective theory of sensation, he would have to explain movements of ether as also subjective, as we to-day do with colour, tone, etc.*"†

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* E.G.N.S., p. 236. † E.G.N.S., p. 243.

Steiner now proves this in convincing fashion. Since the scientists, he says, "cannot conceive motion apart from something that moves, they assume, as the bearer of the motion, matter void of qualities perceptible to the senses. Whoever is not caught by this prejudice of the physicists must perceive that the motion-phenomena are states bound up with the sense-perceived qualities. The content of the undulatory motions which correspond to the tone-occurrences consists of the very tone-qualities themselves. This is likewise true of the other sense-qualities. We know the content of the oscillating motion in the phenomenal world through its becoming an immediate inner content, and not through any process of thinking from inner experiences to abstract matter."‡ "When I direct my eye toward a red surface, then the experience of red enters my consciousness. In this experience, we must now distinguish between beginning, duration, and end. Corresponding to the passing experience, there is supposed to be a continuing objective occurrence which, as such, is likewise limited objectively in time : that is, which has beginning, duration, and end. This occurrence, however, is supposed to take place in matter that is without beginning or end, indestructible, in other words, eternal. This is supposed to be the only lasting element in the process of change, according to modern scientists."* Whereas Wundt says of matter that it is a substratum " which we can never perceive in itself but only in its effects," but that " we first arrive at an explanation free from contradictions when we postulate such a substratum," Steiner, on the contrary, reaches the conclusion that: " the world perceived by the senses is the summation of self-metamorphosing perceptions."† " On the other hand, there is something nonsensical in the concept of the characteristics which the hypothetical matter of the physicists and their philosophical defenders is supposed to possess. These qualities are borrowed from the sense-world and yet they fall to the share of a substratum which does not belong to the sense-world."‡ The severing of our world of perception into one part quantitative and alone objective, which can be grasped only in a mathematical-mechanical fashion, on the one hand, and another part qualitative and only subjective, in the manner in which is done to-day, Steiner rejects as purely arbitrary, and he proves this by such an analysis of the process of perception as deprives of every appearance of justification the method of consideration characteristic of this materialistic age. To follow him in detail at this point would take us too far afield.

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* E.G.N.S., p. 244. † E.G.N.S., p. 194.
‡ E.G.N.S., p. 249.

It is necessary here only to emphasize the fact that, when ether is mentioned in the following pages, we by no means refer at any time to a bearer of mechanical motion-processes or of any sort of changes in electrical states, which is void of all non-measurable characteristics, but, on the contrary, one must always so conceive of ether that its nature and action may be indicated, not only in terms of number, measure, and calculations, but also through qualities just as objectively conceivable but which, in the last analysis always elude any kind of consideration and thought which can be reduced to merely mathematical concepts. Without this insight we shall never do justice to the realities of Nature. This we shall be able to indicate concretely in many spheres of natural science.

Lenard's first restriction of natural-scientific research to a conception of the world capable of being held in a merely mechanical-quantitative manner can therefore not be accepted for the views expressed in the following pages, since such a conception contradicts flatly the realities of the world.

But also the second demand made by Lenard, restriction to what is accessible to the physical organs, cannot be admitted. Indeed, the idea of the world held by the scientists themselves contradicts in all its fundamentals this demand. For no physical sense has yet directly perceived electrons, atoms, vibrations, and other hypothetical factors in the natural-scientific conception of the world, since our physical sense-organs are not yet so organized as to be capable of perceiving ether vibrations, etc. When Professor König says in his treatise "Die Materie": "If, together with theoretical science, we look upon the atom or ether as the only reality, and consider bodies perceptible to the senses as mere phenomenal entities, we have already gone half-way over into the realm of metaphysics,"* he therein admits directly that science itself does, as a matter of fact, commit constantly in its basic concepts and hypotheses this supposedly fundamental error, which it would fain avoid, of passing beyond the limits of that which is perceptible to the senses.

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* E.G.N.S., p. 208. † E.G.N.S., p. 209.
‡ E.G.N.S., p. 250.

We must make clear, then, first of all, what kinds of hypotheses are legitimate and what kinds are not. Steiner says†: "An hypothesis is an assumption made by us as to which we cannot convince ourselves directly, but only by the way in which the hypothesis works. . . . A (legitimate) hypothesis can assume only that which I do not perceive but which I should perceive if I could remove the external obstacles. An hypothesis, then, may certainly assume the not-perceived, but it must assume that which is possible of being perceived. Every (legitimate) hypothesis is, therefore, of such a sort that its content may be directly verified by future experience. Only hypotheses which are capable of ceasing to be mere hypotheses are legitimate." In this sense the atomic hypothesis, the ether hypothesis, of modern natural science are illegitimate, since neither the "ether moved discontinuously in space and penetrable" of Lenard, nor the ether of other investigators, nor the matter void of all characteristics perceptible to the senses, such as is hypothetically assumed in the contemporary conception of the world, can ever be perceived by our sense-organs.

On the contrary, that ether which is to be set forth in the following pages is both a legitimate "hypothesis" and also a reality subject to proof. How is this? Spiritual science, as given its determinative direction by Anthroposophy, teaches and proves that, in addition to the sense-organs of the physical body, man possesses in other departments of his being other potential organs which, when once awakened by the discipline of spiritual science, are capable of perceiving and also investigating the facts of supersensible spiritual processes in a manner just as clearly conscious and real as that in which the physical organs perceive the physical world. Realities, then, which are thus open to the capacities of perception that can be awakened in every man of our age may not only be introduced into an hypothesis legitimate in the sense we have explained, but must be included just as exactly and methodically as results of research among the data of our knowledge of Nature in the future as are the realities of the physical world as given to the sense-organs.

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* Edmund König, Die Materie, Göttingen, 1911, p. 76.

† E.G.N.S., p. 146.

Now, ether especially—that is, the sum total of etheric processes—belongs admittedly to a supersensible reality. The future scientist may take either of two choices with reference to findings enunciated as a result of research in the supersensible :—

1. He may assume these as hypotheses, as he has done with the conception of the atom and the ether, and may then observe whether these hypotheses are substantiated by their effects and their manifestations in the physical world. As an hypothesis, the findings of supersensible investigations are not postulated differently for him from any others. He will then quickly observe that this hypothesis—such it will still be to him—offers much more far-reaching possibilities than other hypotheses for an entirely consistent explanation of the phenomena of the physical sense-world—indeed, even for the understanding of phenomena whose comprehension on the basis of previous hypotheses was impossible : for example, the life-processes. He will see thus that this hypothesis will withstand every reasonable scientific test.

2. Or he can, in the sense of the requirement stated above, rid himself of the obstacles which prevent his perception of the supersensible world, as explained in the writings of Dr. Rudolf Steiner, and he will by this means attain to the possibility of having the hypothesis of ether become the perception and knowledge of ether.

The proper goal of scientific research in this field can naturally be reached solely in this latter way. Every investigation of ether will forever exhaust itself in still more complicated hypotheses, if it does not advance to the point where the etheric is brought within man's perceptual and cognitional realm. Indeed, being truly scientific consists in this : that one should never decline to test and put in its proper place any attainable experience. Whoever, however, will not himself yet follow this path of supersensible research, to him is given here an hypothesis, as we have said, which—if applied to the actualities of the sensible physical world—is better adapted to the incontestible explanation of these phenomena, and especially the phenomena of life, than the contradictory ether hypotheses of the most recent times, now becoming more and more untenable.

Chapter I

FUNDAMENTALS OF A NEW THEORY OF MOTION

" Oh most wondrous righteousness of the primal Author of all motion ! "
LEONARDO DA VINCI.

IN order to form a clear conception of the essential nature of cosmic ether, it is necessary, first of all, to come to a new conception of the nature of motion, into which all the phenomena of Nature are ultimately reduced by the scientific research of recent centuries. For in regard to the nature of ether and its relation to " motion," the views of the most recent investigators are altogether at variance with one another even in the most elementary and basic questions. While Lenard, the distinguished investigator in this field, rejects the theory of an " ether continuous through space and moved as a continuum " and would substitute " ether moved not as a continuum in space," yet, on the other hand, immobility is just the one mechanical characteristic which H. A. Lorentz would still attribute to ether ; and, finally, according to Einstein, " the whole change in the conception of ether the theory of relativity brought about, consisted in taking away its last mechanical quality, namely, its immobility."* As opposed to these, Lenard now conceives, according to a report, two ethers : one at rest, a primal ether filling the whole cosmos, and another ether borne along by the heavenly bodies like the atmosphere. Thus we see that in regard to the fundamental question, *whether the ether, the ultimate something which lies at the basis of all phenomena, moves or does not move,* the views of the most noted investigators are widely separated.

Therefore, we must first of all seek to establish clearly and fundamentally the true nature of motion in the natural world. In order to take as our point of departure something actual, which may be a part of the daily experience of every man—always the best standpoint from which to approach such a problem—let us consider a motion-phenomenon of man's own body and originated by himself : for example, the raising of my arm. Here, first of all, three elements yield themselves to observation.

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* Sidelights on Ether and Relativity, London, 1922, p. 11.

1. An ego; that is, something possessed of spiritual being which wills to raise the arm.

2. A medium, which conducts the volition of the will to that which is to move—the arm. That this must be present, and is not identical with the will, or the ego or the possible bearer of the ego, can be shown by stimulating the appropriate nerve centre, through an influence introduced from without, whereupon the result will be, likewise, the motion of the arm.

3. That which is moved—the arm. This alone can I perceive with the physical senses.

One who adheres to the modern quantitative-mechanical world conception will say, however, at this point: The first element belongs to the field of metaphysics, and does not concern me; the second is—presumptively—an electric (or etheric) force; the third is a "material body," which undergoes a change of place, a motion, that may be quantitatively-mechanically determined.

Now, what conception or understanding of this *indivisible entity*, the motion of my arm, is possessed by the observer who restricts himself to what is quantitative-mechanical and perceptible to the senses? Really only one-third, so to speak, of the totality of facts which, however, only when all combined together comprise unitedly the reality "the motion of the arm." And this one-third is the change of place on the part of a previously unmoved body. Although I can, in fact, grasp this third, up to a certain point, in quantitative-mechanical fashion, yet my thinking becomes false and arbitrary the moment that I undertake to grasp in this way the second and the first third of the entity under observation—that is, when I carry over my conception of motion, a change of place on the part of a body, into the remainder of this phenomenon, which is not perceptible to the senses, and would understand this also as solely a change of place, quantitatively-mechanically explicable—that is, as motion. Because the physically perceptible time-and-space process of change of place on the part of the arm can be quantitatively-mechanically understood, modern science now seeks to explain also in quantitative-mechanical fashion the fundamental underlying electric-etheric process. And this brings us to the important question which Dr. Rudolf Steiner has expressed as follows*: "Whether there does not lie at the basis of the various natural phenomena, light, heat, electricity, etc., one and the same form of motion in the ether? Hertz had already shown that the same law governs the propagation in space of the action of electricity and that of light. From this we may conclude that the waves which are the bearers of light lie also at the basis of electricity. It had, indeed, already been assumed that in the spectrum of sunlight only one kind of wave motion is active, which will produce the effects of heat, light, or chemical action according as it strikes reagents sensitive to heat, light, or chemical action. But this is clear a priori : When we seek to discover *what happens in that which is extended in space while the entities under consideration are being transmitted therein, we must conclude that it is always a uniform motion. For a medium in which motion alone is possible must react to everything by way of motion.* And all the kinds of transmission which it must perform will be carried out by way of motion. When, therefore, I seek to discover the forms of this motion, then I shall not *learn what the thing is which is transmitted,* but only in what manner it is conveyed to me. It is sheer nonsense to say that heat and light are motion. *Motion is merely the reaction of matter capable of motion to the action of heat and light.*"

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* Rudolf Steiner: E.G.N.S., p. 230.

All, therefore, that we learn when we carry over the quantitative-mechanical method of observation into the field of electric-etheric phenomena is always merely the reaction of the substance capable of motion to the action of heat, light, tone, etc. The real nature of these entities, which consists, not only in motion, but also in other qualities not perceptible to the physical senses, can never be learned by applying to these entities mechanical-mathematical conceptions.

The physicist will, of course, say : " My measurements and observations show me that the measurable and calculable part of the motion-phenomenon in the propagation of sound can be represented by means of certain mathematical equations. The state of motion in the medium conveying the sound—in this case, essentially the air—is determined by certain quite definite numerical values of the constants found in the equations, and in such a manner, indeed, that a quite definite quality of the tone conveyed is co-ordinate and indeed identical in significance with each value of these constants. When the numbers are given, the tone-state is known." There can be no doubt that contemporary physics, in the sense of its ideal here expressed, considers the essential nature of tone to be calculable because it believes that it has succeeded in the case of a part of the tone-qualities in calculating and measuring the mathematical relationships and numerical values of the constants. But the assumption that the totality of the tone-phenomenon must be calculable is merely an assumption based upon the wish to be able to calculate everything everywhere in the world and then to read mechanically, from the scheme thus attained, what is occurring. The fruit of these acoustics is the gramophone. One gets no nearer to the real nature of tone through calculating the state of motion of the tone-conveying medium than one gets to the nature of a man when one knows the number of steps he takes in a day or how many kilograms of nutriment he assimilates. These numbers are useful and necessary to know for certain purposes, only it is fallacious to consider everything calculable. Moreover, whoever knows the form of these calculations knows that they are far from being certain and clear. Only the layman is inclined from what he reads in the newspapers and popular magazines about mathematical calculations to draw the conclusion that all occurrences are calculable. The real investigator was—at least, at an earlier period—far from the illusion that even an essential part of the world-event is calculable. Only because of the justifiable enthusiasm over the undoubted results in those fields where mathematics really apply to the phenomena has the hasty conclusion been drawn that everything must be calculable. When, on the other hand, the physicist or any sort of calculating scientist says that only what he can calculate and what is subject to calculation belongs at all to science ; that everything else may, indeed, be interesting but affords no certitude, and only where certitude is present by reason of calculations is there science,—to such a point of view we may reply that such a scientist thereby declines to grapple with the greater part of the world-content, and that he simply ignores this part of the world-content through his assertion that it cannot be scientifically approached.

In order more completely to clear up this question, we must here consider more thoroughly the " capacity of fixity," the conception of the "inert" body—the opposite, that is, of motion. Steiner says this is generally defined in physics as follows : " A body cannot alter its existing state of motion apart from a cause operating from without. This definition gives rise to the impression that the concept of a body in itself inert had been drawn out of the phenomenal world ; and Mill, who does not himself go into the question at all but turns everything upside down in the interest of a forced theory, does not hesitate a moment likewise to explain the matter in this way. Yet this is all quite false. The concept of an inert body is a purely conceptual construction. For, if I call that which is extended in space ' a body,' I can conceive *two sorts of bodies : those in which changes are brought about by outside influences, and those in which changes occur from an impulse of the bodies themselves.* If, now, I find in the outer world something which corresponds to the concept I have formed—' a body which cannot alter apart from an impulse coming from without '—then I call this thing inert, or subject to the law of the property of fixity. My concepts are thus not taken arbitrarily from the sense-world, but freely formed as ideas, and only through their help do I find myself rightly adjusted to the sense-world. The definition above can only read : A body which cannot of itself alter its state of motion is called inert."*

I must, therefore, distinguish between bodies which can *of themselves* alter their state of motion, and those which cannot do this of themselves. And this brings us to one of the most essential distinctions in Nature : that between *the organic* and *the inorganic.*

While inorganic Nature cannot of itself alter its state of motion, organic nature, on the other hand, by reason of its inherent possibilities, is able to do this of itself ; however much this capacity varies in the most widely separated degrees from men to plants, yet it actually resides always in that which is organic. Now that which causes a carnation, for example, to grow always and absolutely from the seed of a carnation, and never any other plant whatsoever, that which induces this movement of growth, is not something which I introduce from without into the seed but something which resides within it by its own nature. The objection may be raised that the seed must be buried in the earth in order to become a carnation and does, therefore, require a push from without. Such a thought, however, would be false, for " I cannot say this influence from without produces this effect, but only that *to this definite influence from without the inner active principle responds in this definite fashion. What happens is the result of an inner conformity to law.*"† Whatever may be the character of the external stimulus, the inner active principle in the seed of a carnation will, if it works at all, respond always only with a carnation. When Haeckel wrote in reference to a similar process in the lower orders of the animal kingdom : " In the case of more than four thousand species of radiolaria which I have described, every single species is distinguished by a special form of skeleton ; the production of this specific skeleton, often of a highly evolved form, by means of a cell of extremely simple form (generally globular) is intelligible only when we ascribe to the formative plasma the capacity of forming a concept," in such a statement Haeckel may be going, perhaps, beyond due bounds because of attachment to his own theory, yet he was forced to assume in the primitive globular cell an inner active principle of its being which first manifests itself in the completely developed animal, and which, in so far as it expresses itself in the movement of growth, belongs to that extent to the category of motion-phenomena, like any other sort of motion. In the case of all these phenomena, we have to do every time with a thoroughly objective set of facts, which, when we would comprehend them as merely quantitative-mechanical motion-phenomena, we thereby immediately fail to grasp in the innermost essence of their being.

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[*] E.G.N.S., p. 204. [†] E.G.N.S., p. 143.

If I assume a formative power in the seed or in the primitive germ-cell, then I must also conceive this power as being united with the " idea," with the " will," to become a carnation—or to become the animal in question—just as with the capacity for motion and change of motion. The former cannot be separated from the latter by any arbitrariness of thought. This is the case in all organic processes—that is, universally wherever there is " life " ; and, if modern science continues to place the restriction upon itself of understanding nature only mechanically and quantitatively, then it must restrict itself to the investigation of the lifeless, of the mineral. For this such a world-conception is supposed to suffice—but even for this it does not really suffice, as we shall later show. So that even Lenard, although he holds to the atomic and mechanical conception of the world as being indispensable for modern natural sciences, is forced to confess : " When, however, tens of thousands and hundreds of thousands of atoms form a molecule, so that this is a highly complex little world in itself, as for instance it must be in a molecule of protoplasm, the molecules may then enclose within themselves that which we call spirit. They then become the bearers of the *wonderful phenomena of life, which the scientist of our day, with his conceptions which in other ways serve him so marvellously, is entirely unable to explain.*"

But does not, then, the restriction of our world conception to that which is mechanical-quantitative and perceptible to the senses involve also restricting ourselves to agnosticism, to *ignorabimus,* for ever ?

And are there, after all, anywhere in Nature motion-phenomena which, when explained consistently on the basis of the quantitative-mechanical view, can be fully comprehended ? " Since, without the existence of forces, the parts of hypothetical matter would never begin to move, therefore the modern natural-scientists assume force also as one of the elements by means of which they explain the world, and Du Bois Reymond says : 'The understanding of Nature consists in reducing changes in the corporeal world to motions of atoms, brought about by their central forces independent of time : or, in other words, the resolution of the phenomena of Nature into the mechanics of atoms.' Through the introduction of the concept of force, mathematics goes over into mechanics."*

In every motion, therefore, according to this conception, there is an expression of a force. But, in that case, every motion-phenomenon has also two aspects. In so far as it is perceptible to my senses, I can up to a certain point conceive it quantitatively ; but, in so far as it is the operation of force, I can neither perceive it through the physical senses nor determine it fully through quantitative measurement, since

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*E.G.N.S., p. 235.

I can never measure force in itself but always only in its physical effects. But, then, do force and motion stand in relationship to each other only as cause and effect ?

They do not. In every motion-phenomenon, we have to do with the following indivisible totality :—That which is moved, which we perceive in the phenomenal world ; through this we become aware, at the same time, of something not perceptible to our senses—a force ?—, which expresses or manifests itself in that which is moved. The entire phenomenon—in the case, for example, of a man who moves his arm—is clearly linked up with phenomena of consciousness. Now, as man is a single indivisible entity, I learn nothing essential in regard to the motion of an arm if I only establish quantitatively the change of place on the part of the " material " arm ; what I thus learn has to do only with the nature of the motion of a lifeless arm, which, however, would not of itself have performed this movement ! I can, therefore, understand the nature of this motion-phenomenon as a whole only when I view that which is moved and the action of the force there manifested—linked up with phenomena of consciousness—as a unity, and not arbitrarily separate these. If I divide this unity by considering alone the process which is quantitative and perceptible to the senses, I not only separate cause and effect, but I part from one another real Being and phenomenon. Since the phenomenon is only an externalization in a form perceptible to the physical senses of the spiritual entity there coming to expression, of the real Being—that is, of an individual reality—and is not to be separated from this Being, therefore when I consider alone the quantitative, measurable process I am dealing with an unreality in the fullest sense of the term.

Is it otherwise in the case of animal, plant, and mineral ?

We can readily take the right attitude toward this question if at this point we divide into the following categories the totality of motion-phenomena occurring in the world.

1. *Motions in which there comes to clear manifestation the action of a self-conscious being*, the bearer of a will (for example, a man who wills to move his arm and carries out this volition).

2. Motions whose *ultimate inducing* cause is still unknown to the sciences of our time : motions which are not produced by a man or not subject to his will ;

   (*a*) in the organic world,
   (*b*) in the inorganic world.

We can, therefore, divide the *totality of motion-phenomena in the cosmos into those in regard to which we can know directly through the perception of our physical senses the being from whose " will " they have taken* *their origin (for example, man) : and those motion-phenomena in the case of which the primary stimulus to motion escapes our view ; that is, those in the case of which we do not know the being out of whose will the motion took its origin.*

If we conceive of life—that is, of the expressions of life in the organic world—as a totality of self-metamorphosing motion-phenomena (motion of growth, motion of metabolism . . . .), then he who is determined at all costs to understand the world mechanically takes upon himself the task, already shown to be impossible, of understanding as mere mechanics the phenomena of life. He must either resign himself and give up any understanding, or else he must say to himself that in the inner active principle which always causes the seed of a carnation to become a carnation a "will to become a carnation" finds expression,—a will which I simply cannot measure, weigh, or define by other mechanical means. But this "will to become a carnation," which brings the being of the carnation over into the phenomenal world, is inseparably linked as an attribute to the inner active principle, that force-complex, through which the seed of the carnation grows into a carnation,—that, therefore, which causes and determines the entire motion-phenomenon, both quantitatively and also qualitatively. As we have already said, the forces of the surrounding soil are certainly helpers in this process, but the individual impulse, that of becoming a carnation, is something which resides only within the seed of the carnation, and—unless we are to believe the absurd and naïve theory of preformation—is to be understood only when we view the force-complex residing in all seeds of carnations (etheric force-complex, we shall see) together with the "will to become a carnation" as the spiritual attribute inseparably linked to the seed. (We shall take up this process in concrete fashion in connection with our discussion of Mendelism, etc., Chap. XI.)

Yet an essential difference distinguishes this sort of motion, of course, from those considered in connection with man. The individual will of my own ego occasions the motion of my arm, producing the motion by means of the material body, the arm, through the medium of the electric-etheric forces residing in my organism. In the case of plants, however, a group-will controls, a will which induces in a multitude, a group, of bodies of a similar kind a like motion-phenomenon : the motion of growing into carnations, and this likewise through the medium of (etheric) forces. As we shall later see (Chaps. III and XI), this act of will is not free, as in the case of man, but the activity of the earth organism is linked with it in a causal way ; yet it is not determined in its individuality, in the character of its being, by the earth organism—otherwise all plants would be alike—but is influenced in its own action only as to local modifications, and as to point of time, etc. We shall observe this action in detail in connection with a discussion of the phenomena of the force-currents of earth and atmosphere. That riddle of the ascent of water in plants during the spring will then be possible of interpretation on the basis of this reciprocal play of etheric forces in plants and the earth organism.

We have, then, in the case of man, seen the individual volition as cause and as accompanying phenomenon of the action of electric-etheric force, and thus as inducing cause of a motion-phenomenon in substance (the arm); but in the case of the plant, we have seen the group-will as uniform inducing cause of a motion-phenomenon, likewise wrought through etheric forces—that is, of the movement of growth.

In considering motion-phenomena in the inorganic as a whole, which to superficial observation appear most readily understood, we must, nevertheless, by means of more exact investigation, penetrate as far as possible toward the ultimate cause of such motions. For, whereas movement carried out or induced by the will of a man brings directly before our eyes the inducing cause of this movement in the human individual, and while, in the case of organic Nature, we can observe—though chiefly in individual instances of its effect in the phenomenal world—that inner principle of action which expresses itself in the growth, etc., we come in the case of the movements of the inorganic—those not induced by human will—upon that "regressus ad infinitum," which finds its expression in the second of the seven world riddles enumerated by the distinguished natural-scientist Du Bois Reymond in his "Grenzen der Naturerkenntnis": *The question of the primal cause of all motion!*

For, if we have already distinguished between such bodies as can of themselves alter their state of motion (the organic) and such as cannot do this (the inorganic), then, in the case of the latter, if we would discover the ultimate first cause of a movement, we must simply follow back the "regressus ad infinitum" to the very beginning of the world. For the flowing water of a brook, a stone rolling down hill, tending toward the central point of the earth, the wind which moves the leaves, etc., etc.,—all these are only partial expressions of phenomena of the atmosphere, of atmospheric electricity, of meteorology, of earth magnetism, etc., and these phenomena are in turn only partial movements in the totality of the life-process of the earth organism. But this life-process, too, in all its phenomena of life—that is, in everything which is life and motion, not death and immobility—is induced here by the sun, as the science of our day shows. If one continues logically and asks then about the inducing cause of the sun motions, he comes at once to the question of the primal origin of motion—and as to this we will briefly explain our view.

Modern natural science wrongly places at the beginning of all that happens in the cosmos the primal nebula, according to the modified Kant-Laplace theory; and at the end, the heat-death of the entire cosmos, that vast graveyard, into which the scientist, thinking out his law of entropy bravely and logically to the end, allows the world to subside. Between primal nebula and heat-death, according to the view of *modern science, lies all that play which comprises the becoming and the passing away of universe, earth, and man.*

The great physicist and discoverer, Professor W. Nernst, says in his work "Das Weltgebäude im Lichte der neueren Forschung,"* p. 13: "Neither Kant nor Laplace could have realized that their theories of the formation of the world necessarily pre-supposed a limited duration of all events; otherwise they themselves would certainly have denied the universal applicability of their views. It remained for the evolution of the theory of heat,with that sort of assurance which applies to the universe in general a conclusion drawn from the laboratory, to draw the conclusion mentioned above—one certainly unpleasant in the highest degree. It was the famous English physicist Lord Kelvin who first pointed out that, according to the theory of heat set up by Carnot and Clausius, the whole store of force in the world would gradually but surely be metamorphosed into heat, and that just as certainly all existing heat would come to the same temperature. But the world is thereby doomed to eternal rest. The application of the theory of heat—the most universal and reliable of all the theories we possess—to the Kant-Laplace ideas causes the gruesome thought to appear in the background of our minds that the world is striving to bring itself to the state of an eternal graveyard. This is generally expressed by saying that the universe is unescapably doomed to a heat-death." And all who possess religious feeling and who seek for a meaning in human life will sympathize with Professor Nernst as he relates how he reacted as a student to the introduction of this terrible deduction of modern science by a professor of the Vienna Academy in his inaugural lecture. "He remarked, among other things, that all endeavours to save the universe from the heat-death had been futile, and that he also would make no such effort. This passage, which I read as a student, made the deepest impression on me, and my attention has ever since been directed to the matter, to discover whether some way of escape might not appear."

We also ask, therefore: Where is the weak spot in this structure of theory? Dr. Rudolf Steiner answers this question in the following picture:

When the teacher would make clear to the school children the origin of the world-system and its motions, according to the Kant-Laplace theory of the world, he performs this by means of a drop of oil, floating upon water, which—when set in rotation—throws off tiny particles of oil, which, rotating in turn, circle round the central drop of oil. But in connection with this little world-system he forgets always to mention the ultimate essential of the whole process, and the failure to mention this is the weak spot in the mechanical idea of the world on the grand scale. That is, he forgets to call the attention of the children to the fact that he—the teacher—has all the time by his own will been whirling the central oil drop. If he had not done this, his little world system would either never have come into existence or else would come to a state of rest. Moreover, even though he continues to whirl the central oil drop, the other oil drops do not continue for that duration in motion. And so he generally forgets himself, the most important factor in the whole process. He has set the central oil drop in motion, he keeps it in motion, and, if he wishes to keep his little world system as a whole in continuous motion, he must not only continue the whirling motion of the central drop, but he must so multiply himself that there shall be connected with each of the separated oil drops one " who whirls ": that is, who keeps them in steady motion.

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* Berlin, 1921.

But just such a blunder we make in the mechanical idea of the world belonging to modern natural science. This is often not only a certain forgetfulness, but also concealed indolence. For the mechanical idea of the world becomes endlessly complicated if I am required to demonstrate not only that something moves and how it moves (this is really never the main problem of science but merely its working tools), but also in dealing with a motion-phenomenon—that is, if I am to understand it, not merely piecemeal and falsely, but rightly and as a whole—must also answer this question : Through what operative principle is this motion induced ? *What will gave the initial push resulting in this motion, and with what phenomena of consciousness is this act of will united ?*

If we are dealing, for example, with the fact of the setting in motion of the primal nebula, out of which our cosmos is supposed to have come into existence, and if we do not play the part of an ostrich, but admit with logically exact thought the fact that at the basis of this first motion there must have been an *impulse of will, or a multitude of such impulses,* and that these expressions of will were also undoubtedly linked up with phenomena of consciousness, into which we cannot, of course, think ourselves with our present normal objective consciousness, then a twofold question is forced upon us :

1. *With what phenomena of consciousness are even yet linked up*

those operations of force in the cosmos and the motion-phenomena induced by them which do not receive their initial impulse from a human ego?

2. *Are there scientifically exact methods for the investigation of other states of consciousness than that of the normal objective human consciousness of our century?*

The answer to the first question leads to a complete revolution in the mechanical study of Nature characteristic of our time, a method deriving from the theory of " the limitation of the knowledge of Nature " —that is, it brings us to a science of Nature which considers not only the phenomenal world with its phenomena of motion, which as such cannot be understood at all, but also includes in the scope of its research the real being of things which come to living expression in the phenomenal world,—a science of Nature which strives to know and to understand the spiritual, the real, that which comes to active living expression in the working, weaving world of forces.

For such an inquiry into the world, the best guide and surest means of knowledge is the world ether, the etheric.

For such an inquiry, the " spirit " is not something which can be " imprisoned " within a molecule of protoplasm, or—as modern scientific materialism supposes—something which has first come into existence out of the world of substance. On the contrary, for such an inquiry, the spirit is primary, and the metamorphosing moving substance is secondary—created, maintained, shaped, and evolved by the spirit, as one of its manifestations, its phenomenal form, which it can and will again dissolve, when the spirit, as active principle working in substance, shall have brought this from the imperfect to the perfect.

The spiritual, the real, is also continuously now the ultimate cause of all motion: that is, of all life in the cosmos.

For such an inquiry into the world, there is no abstract creation of a primal nebula set in motion in a manner impossible to conceive, but, on the other hand, the involution and evolution of a spiritual activity in the world of substance; a spiritual, a real, however, which was present before there was substance, and will persist after the end of substance (see also pp. 105-115).

The second question stated above, in regard to the development of a human capacity to perceive this world, has been answered in the numerous writings of Dr. Rudolf Steiner in which the way is shown whereby, through the most exact methods, human inquiry concerning the physically perceptible, and as such unintelligible, world of substance can be extended beyond into a direct supersensible view, clearly conscious, of the forces working in this world, the forces of the etheric, and of the spiritual therewith united.

But we should once more emphasize here the fact that even one who is not yet willing himself to take this path may, none the less, test by application to the world of experience what follows in regard to the nature of ether, at least as a legitimate " hypothesis " in the sense explained above—indeed, more legitimate than those of the mechanical world-view ; and that he will find the theory not only confirmed but also rendering possible the clarification of many hitherto unintelligible phenomena.

Let us turn back once more to a consideration of the real and the phenomenal in motion-phenomena of the various realms of Nature. That which has a living expression in the human arm set in motion is a " will," something real, spiritual, therefore, which comes to living expression in the world of phenomena ; in this instance, in the motion of the arm. But other natural phenomena also—the flying pollen of flowers, the falling stone—are always manifestations of an invisible world of forces, whose ultimate first impulse we do not at present know, a supersensible, spiritual, ideal impulse operative in these single events in the phenomenal world. Plato spoke in this sense, out of a primal oriental mystery-wisdom, of a world of ideas. The spiritual, then, the idea—is " not only present and active, where it is consciously known—in man, but also in another form in the realm of Nature. It is not only present in the subject, but is the principle of the objective world."* Eduard von Hartmann conceives of the idea, the spiritual, the real, on the one hand, and the will on the other, as two constitutive world principles standing side by side ; and he looks upon the idea as being at rest, and as requiring, in order to come into activity, the impulse of the will. Steiner shows, in contrast to Hartmann, that these two cannot be separated : " Will without idea would be nothing. The same cannot be said of the idea, for activity is an element of the idea, while the idea is a self-sustaining being."

The world in endless motion, as perceptible to our senses, is, therefore, a manifestation of the ideal world which is in ceaseless action, of the real world of spirit.

Steiner formulates thus the fundamental perception : " Will is the idea itself conceived as force." Then we must not only desire to know the action of forces in the phenomenal world in their quantitative and mechanical aspect, but we must seek to understand the forces working in Nature as linked up with the qualitative attributes of the spiritual entities acting through these. The distinction here between man and the rest of the realm of Nature is this : That in man the spiritual, the will, when it comes to living expression as the inducing cause of manifestations of force in the phenomenal world, is linked up with phenomena of consciousness to which we ourselves are alive, since, not only does the spiritual as objective active world-principle manifest itself in man, but man himself *is* a separated part of this objective active world principle. " Freedom," therefore, belongs to him alone, in contrast with the rest of the realms of Nature given to our perception, since the rest of Nature is only an object of this spiritual activity.

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* E.G.N.S., p. 174.

Nevertheless, a spiritual, supersensible, rules in all the phenomena of Nature,—in the will of the man who moves his arm, in the controlling active principle in the seed as " will to become a carnation," in the falling stone as " will to carry it to the centre of the earth " ; in the content of all these perceptions the real comes to living expression in the phenomenal.

In opposition to those who have proclaimed with premature satisfaction the purely mechanical idea of the world, a few great investigators have from time to time pointed warningly to the weak spot in this mechanical idea of the world so dogmatically asserted. Thus in reference to the science of the inorganic the famous physicist Nernst, in his endeavour to explain the process of chemical changes in substances on the basis of the physical forces working in these, has been forced to resign himself to this declaration* : " The final aim of the doctrine of affinity must be to ascribe the causes of material changes to well investigated physical phenomena. The question of the nature of the forces which come into play in the chemical union or decomposition of substances was discussed long before a scientific chemistry existed. The Greek philosophers themselves spoke of the ' love and hate ' of atoms as the causes of the changes of matter ; and our knowledge of the nature of chemical forces had not advanced very much until quite recently. We retained anthropomorphic views like the ancients, changing the names only, and seeking the cause of chemical changes in the changing affinity of the atoms."

So far goes the physicist and discoverer Nernst. As to the science of the organic, the investigator of organisms, Oskar Hertwig, in his comprehensive book " Das Werden der Organismen,"† sketches the following picture : " Laplace imagined a mind capable of analyzing the whole world-process into the motions of masses mutually attracting and repelling one another, of expressing this analysis in a stupendous mathematical formula, and of calculating the past and the future of the world-process. In like manner let us imagine a spirit whose power of vision so far surpasses that of us ordinary men that he could perceive the tiniest units of substance, the atoms or the elements, and could follow their motions. Endowed with such divine power of vision, he would be capable of actually seeing the building up of all sorts of molecules out of the atoms variously grouped—as the chemist seeks to set these forth symbolically in his structural formulæ—though seeing the process, perhaps, as somewhat different from that which the chemist supposes. . . . For a spirit of such power of vision, chemistry would have become in reality a morphological science ; his eyes, as it were, analyse or dissect molecules into their ultimate elements and obtain a direct view into the atomic morphology of substances. Such a morphologist has actually reached the goal of the mechanistic school. To him the cell is no longer the elementary living organism endowed with structure, but has become a wonderful microcosm of countless molecules. Just as, in cosmic space, the heavenly bodies, held together in solar systems, move in well defined orbits, so would he see the molecules in the microcosm of the cell held together, according to their affinities in smaller or larger groups ; he would perceive, finally, how still more extensive groupings give rise to the forms of substance perceptible to ordinary human vision, which we call protoplasmic threads, granules, centrosomes, trophoplasts, chromosomes, spindle fibres, nucleoli. Although this picture of a future morphology, which would also include contemporary chemistry—thus becoming an all-embracing science of substance—is merely a vain phantasy, in any case the ultimate goal of knowledge would never be reached by this path. For, according to physical theories, even the atom also would have to be conceived in turn as a world of alpha corpuscles. And also chemistry which should seek to replace, by means of chemical knowledge, that which we have learned of the organization of the world of living bodies, would find itself in the same situation."

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* W. Nernst, Theoretical Chemistry, London, 1923, p. 517.

† Jena, 1916, p. 38.

Thus, equally for the inorganic and the organic, distinguished experts in modern science have in turn pointed out the narrow boundaries of our present-day research into Nature. When Hertwig says that a morphologist who, by means of vision assumed to be his, sees through the play of forces in the world has " reached the goal of the mechanistic school," I might reply to him—and he would agree : But such a morphologist would certainly no longer belong to the mechanistic school, because in the action of the formative forces in the world of substance he would experience the impulses of spiritual entities, and because the world would appear to him, not as a mechanical apparatus of substance, but as a living organism, guided continuously by the spiritual, and striving through all its phenomena of motion toward the goal.

Just as a man—even the merely physical human body—cannot possibly be understood by studying a corpse, no more can any phenomenon of motion belonging to the phenomenal world be understood apart from the spiritual entities which impel it. And, just as the world of phenomena—this has been shown by the most recent investigations, not only in the realm of the living, but elsewhere also—can either not be understood at all, by means of the quantitative-mechanical method, or else understood only in one small section, arbitrarily selected and by no means the most essential, so also, when we enter the world of forces, of the etheric, we shall not only be unable to understand anything by means of the quantitative-mechanical method abstracted from the phenomenal world, but shall thereby render the confusion in our conceptions of these entities only the greater.

The ether of the general theory of relativity also, which, as Einstein says,* is a " medium void of all mechanical and kinematical qualities, but which helps to determine mechanical (and electro-magnetic) events,"† and which " cannot be thought of as endowed with the quality characteristic of ponderable media, as consisting of parts which may be tracked through time "‡ to which " the idea of motion may not be applied," and yet which must have the capacity to determine the " configurative possibilities of solid bodies as well as the gravitational field," § etc.—such an ether has, to be sure, the advantage of being stripped of many false attributes of the mechanistic ether, and yet it gives no full picture of reality.

Ether—or, more correctly, the etheric primal forces, formative forces—as they lie at the basis of what herein follows, and as they correspond with reality, do not belong, as such, immediately to the world of phenomena, and they are, therefore, like all forces, imperceptible to the physical senses ; they belong to a supersensible set of facts. But, then, as such, they are to be understood only when we consciously bear in mind in our investigation concerning them that something real, the very beings of things, comes with these forces to living expression in the phenomenal world. The ether—or the etheric primal forces, for there are several as will be shown in the following pages—are, therefore, neither to be understood merely mechanically—as with Lenard and others—nor simply by the negation of all mechanical characteristics, as with Einstein. But, when, as supersensible active principles, they come to living expression in the phenomenal world, they call forth, in this world perceptible to the senses, phenomena of motion, etc., which may, then, only partially and up to a certain point, be considered mechanically. The etheric formative forces, however, are, in themselves, inseparably linked up with spiritual, and therefore qualitative, characteristics—indeed, in the last analysis with that which is individually spiritual. That is, we must ascribe to them, not only such characteristics as velocity, mass, length, volume, etc., which are measurable and calculable, but also characteristics whose laws in the last analysis can just as little be exhausted through numerical estimates as the characteristics of a living man can be exhausted by a table of constants and a sum of mathematical formulæ. We shall be able, therefore, to form a conception of them only when we observe and investigate them as such entities.

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* A. Einstein, Sidelights on Relativity. I., Ether and Relativity, London, Methuen, 1922.

† p. 19. ‡ p. 24. § p. 20.

Chapter II

THE ETHERIC FORMATIVE FORCES

WHAT we perceive in Nature by means of our sense-organs—as every person trained in science and philosophy knows—is not in reality substances and forces but states and the changing of these into one another. " The senses inform us in regard to states. If we speak, then, of something other than states which undergo transmutations, we are no longer restricting ourselves to the bare facts of the case, but are adding concepts to these."* When we go beyond the states and their metamorphoses given to us by the senses, a twofold question then forces itself upon our thought : 1. What maintains the given states in the form in which they now exist ? 2. What in given instances causes the metamorphosis from one state to another ?

If we begin, not like Newton from the standpoint of matter, of the bodies, but like Goethe from that of the primary forces, we must reply to both these questions : *The etheric primal forces (formative forces). In so far as they are united with bodies in the phenomenal world, these bodies continue in that state induced by them, until such time as free etheric forces of another sort, or stronger ones of the same sort, bring about a metamorphosis of the existing state.*

We shall be able to pursue this idea in the most varied examples in Nature. But at this point we must first give a conception of the nature and the action of the etheric forces. Lenard writes : " Because of the identity of electric waves and light waves, we are sure that the same ether which brings us light, heat, and all energy from the sun also conducts the electric and magnetic forces. . . . A single ether for light, heat, and electricity—thus did Lord Kelvin express the great achievement of the electrical researches of Hertz." This error Dr. Steiner combatted as early as 1888, in the words already cited : " When we seek to discover what happens in that which is extended in space when the entities under consideration are being transmitted therein, we must conclude that it is always a motion. For a medium in which motion alone is possible must react to everything by way of motion, and all kinds of transmission which it must perform will be carried out by way of motion. When, therefore, I seek to discover the forms of this motion, I shall not learn what the thing is which is being transmitted, but only in what manner it is conveyed to me. It is sheer nonsense to say that heat and light are motion. Motion is merely the reaction of matter capable of motion to the action of light."

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* Rudolf Steiner : E.G.N.S.

The conclusions which were arrived at from the researches of Hertz, led not only to the error that from the mere effects which are produced in the ether, a medium capable only of motion, too much was concluded regarding the very nature of the ether itself, but also to the erroneous assumption that—because of the uniformity of the reaction of the perceptible medium (that is, substance) to the actions of the ether—therefore a single ether calls forth all the effects. But this error is fundamental and has blocked the way to reality before all further researches in ether.

As a matter of fact there are altogether seven etheric primal forces, formative forces, active in the cosmos; of these, however, only four reveal themselves in the space-and-time processes of our present phenomenal world. In what follows, therefore, we shall deal only with these four etheric formative forces.

Anthroposophical spiritual science designates these four kinds of ether as:—

Warmth ether,
Light ether,
Chemical ether (or sound ether) and
Life ether.

In characterizing the differences among the four kinds of ether we cannot restrict ourselves to the ascertained fact that they are distinguished in comparison with one another by the wave-lengths—that is, the degree of motion—which they call forth in the world of substance. Such merely quantitative distinctions of modern science do not at all suffice to explain the phenomena, qualitatively so utterly unlike, which the different kinds of ether produce in the world of substance. The relationship existing among the etheric formative forces is, rather, the following: The four etheric formative forces have proceeded phylogenetically one out of another, and proceed now ontogenetically one out of another; and, in reality, warmth ether has been metamorphosed—that is, has evolved into light ether; light ether into chemical ether; chemical ether into life ether. Further, the mutual relation between the etheric forces is such that the later ether, more highly evolved, always contains in itself the attributes of the earlier, yet always develops, as a new entity, an activity clearly distinguishable from that of the other.

Thus the life ether contains in itself the warmth ether, light ether, and chemical ether; the chemical ether contains the light ether and warmth ether; etc., etc. Nevertheless, each ether acts in the manner characteristic of itself alone; and only when, through having penetrated into the substance-world, it has been modified, may a higher ether, for instance, be reduced, as it were, to the action of a lower. Warmth ether, from which the other ether forces have evolved, has in turn come into being out of purely spiritual states outside of time and space. Of these we shall speak later.

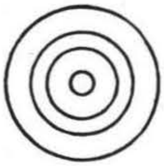
The four kinds of ether may now be classified in two groups, and this distinction is of fundamental importance for the understanding of all that is to follow:—

The first two, warmth ether and light ether, have the tendency to expand, the impulse to radiate out from a given central point; they act centrifugally; whereas the other two, chemical ether and life ether, have the tendency to draw in toward a centre, the impulse to concentrate all in a given central point; their action is suctional, centripetal. This polarity of the two ether groups—the centrifugal, radiating, self-expanding will, and the suctional, centripetal will to draw inward, to concentrate—is an ultimate elemental principle lying at the bottom of all natural phenomena. This will be indicated hereafter for a great many fields of natural science.

Individually, the four ethers have the following characteristics. The etheric commences with the first state of ether, that of warmth ether. Present-day physics views "heat," not as an objective state, but only as a subjective quality called forth by a form of motion. Here also, however, the results of the theory of relativity have within a very recent period greatly modified or completely transformed many conceptions long held to be unassailable. Professor L. Graetz in his work "Der Äther und die Relativitätstheorie," which boldy denies many conceptions hitherto in constant use, thus states the problem (p. 62): "Whereas heat was considered at an earlier period to be a substance, something material, this substance theory has been abandoned since the middle of the last century, and heat and energy in general are considered as something kinetic. The second conception of the law of energy, according to the theory of relativity, conflicts with this purely kinetic theory; it conceives energy as something material. Mass is, of course, something material; and, since every change in energy is bound up with a change in mass, the theory of relativity views energy as something material, as an energy-substance, not as a motion, or at least not as motion alone. Thus it appears that energy must be conceived in the theory of relativity as energy-stuff." To future observation of

Nature, heat, embraced by such observation in its totality, will, in its essential nature, be just as objective a state as the gaseous, liquid, and solid states of aggregation in substance. " Heat " processes are a transition stage from the purely etheric to the so-called " substantial," and *vice versa* (see pp. 115-118). We shall be able to convince ourselves of this fact from many points of view in the further course of these reflections. It will be shown later on that only through the action of warmth ether do heat phenomena arise (Chap. VII), whereas the other phenomena, light, chemical processes, etc., possess quite different qualities for the reason that the etheric forces themselves which call forth these phenomena are marked by quite different qualities.

Warmth ether tends towards the *spherical* form. If it were merely a conveyer of " motion," then it could in turn call forth only motion in a substance-medium in which it works. Since, however, the tendency to create spherical forms is inseparably linked with its action, therefore it calls forth, wherever it enters into Nature and is not obstructed in its action, spherical forms. We are here dealing—and this must again and again be emphasized—not with abstract dead oscillations of unknown origin, but with concrete formative forces.



The second ether state is that of *light ether*, or, more simply, of that which is given to the physical perception of man as " light " (for details see Chaps. VII and VIII). As Lenard says, light gave us the first intimation of the existence of ether, and he thinks " Light is undoubtedly a transverse wave motion : that is, in a beam of light and perpendicular to its direction—never merely backward and forward displacements in the same direction with the beam, as is the case in sound waves—there are present periodically shifting states. Optical researches by no means recent—for instance, those in regard to polarization of light, have already shown the transverse character of light waves. In the course of time we have learned to recognize still other ether waves which are invisible : ultra-violet, ultra-red, and electric waves ; but these as a group have the same characteristics as light waves, differing only in their lengths."* That the " characteristics " are similar, the lengths different, may satisfy us so long as we are testing in a one-sided and arbitrary fashion the quantitative-mechanical action in the substance-medium ; but in this way we learn nothing whatever in regard to the natures and the concrete distinctions of the different kinds of ether. The light ether to which we refer, which calls forth for the human eye in the manner to be explained later the phenomenon of light, does in fact induce among other things a transverse oscillation ; but in addition to what has been said above we must add that this occurrence describes the figure of a triangle (see below), so that light ether, as we shall see, when it can exert its effect unhindered in Nature, also produces there *triangular forms*, whereas warmth ether produces spherical forms.

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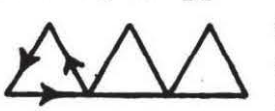
* loc. cit., p. ii.

We agree entirely with Lenard when he says : " We must take the characteristics of ether just as we find them in order to base these upon experience and seek to harmonize them in a conception free from contradiction ; and we must not permit ourselves to be disturbed in this—a serious error which, I think, has often been made—if we find that *these characteristics are entirely different from those of matter in solid, fluid, or gaseous forms*. For ether is simply not matter." When, however, he proceeds further, saying : " and it is legitimate for us only by way of comparison to draw upon matter at all, in order that, proceeding from our knowledge of the motions induced in matter, we may endeavour to reach a conception of the motions in ether," we must remark in regard to this, as we have already said in Chapter I, that we shall never be able to reach a true conception of ether by transferring the forms and laws of motion in matter to the ether itself. If, however, we conceive of ether, or the etheric formative forces, as formative forces void of any quality of substance, as active principles which come to living expression in the phenomenal world only through their active tendencies to definite motions, to shaping definite forms with definite qualities, then this difficulty disappears (see pp. 36-37). We may say, then, that an oscillation, a form which is caused by light ether in a substance-medium, takes the shape of a triangle. (See also Chaps. XI, XII.)



The third ether is *chemical ether*, or *sound ether*. Its forces, that is, cause the chemical processes, differentiations, dissolutions, and unions of substances ; but also—though, as it were, through activities in another field—its forces transmit to us the tones perceptible to the senses. The inner kinship of these two spheres of action will be clear to us from the phenomenon of Chladni's sound-forms. For it is tone which causes the uniting together, the orders and forms, of substance and bodies of substance. " That which the physically audible tone produces then in the dust is happening everywhere in space. Space is interpenetrated by waves produced by the forces of chemical ether,"* which, in the manner of the Chladni dust figures, dissolve and unite substances. But chemical ether has in reality " a tone-and-sound nature of which sensible sound, or tone heard by the physical ear, is only an outward expression : that is, an expression which has passed through air as a medium."

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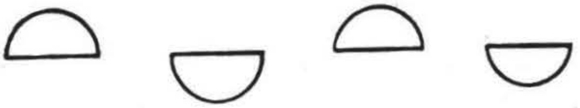
* Rudolf Steiner : E.G.N.S.

We shall discuss more thoroughly in Chapter IX the origin of tones audible to the senses; here we must only establish the fact that tone and chemical processes are to be attributed to the same ether in the manner explained.

Chemical ether, when it can exert itself unhindered in Nature, produces, as we shall be shown concretely, *half-moon* forms.



In contrast with the expansive kinds of ether—warmth and light ether—chemical ether, as we have said, tends in its action to be centripetal.

It may also be proved that the phenomenon of cold is one of those attributes which are to be ascribed to chemical ether, a fact which is essential for an understanding of the relation between processes of cold and of contraction.

The fourth ether is *life ether*. It is phylogenetically the most highly evolved ether, and therefore in its qualities most varied and complicated, as we shall later show in connection with the most varied phenomena. It is, as we shall see, that which is rayed out to us, among other things, from the sun and then modified in its action by the atmosphere of the earth in a manner to be described in the following chapters. Life ether, together with chemical ether, belongs to the group of suctional forces, those which tend to draw inwards. We shall also be able to prove its relation to that which is called "gravitation" and to the phenomenon of magnetism.

Its form-building tendency, when it can exert its effect unhindered in substance, leads to *square* shapes, expressed, for instance, as we shall show later, in crystallizing salt.

By way of resumé then, we may say:

There comes into existence phylogenetically and ontogenetically out of the non-spatial state:

	Spatial tendency	Form tendency	State induced*
Warmth ether	Expansive or	Spherical	Heat
Evolved therefrom, Light ether	Centrifugal	Triangular	Gaseous
Evolved therefrom, Chemical ether	Suctional Drawing inward	Half-moon shaped	Fluid
Evolved therefrom, Life ether	Centripetal	Square	Solid

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* See next chapter.

The States of Aggregation of Substance and the Etheric Formative Forces

We have shown that what we really see in the phenomenal world is " states and their metamorphoses into one another." These may be grouped, first of all, into the four states of aggregation : the solid, the fluid, the gaseous, and the fiery, or heat, state. That the last is in fact an objective state and not only an imaginary " motion " bringing about in the human organism the subjective heat-experience,—this we have already discussed above (see p. 23). Fearless investigators have already been compelled recently to assume a certain state beyond the gaseous and different from it, but they have not been able yet to reach a concrete conception of its nature (see Chap. III). As a matter of fact, the heat-state is present quite independently of the others, as is evident on the following grounds. If we wish to answer rightly the twofold question naturally arising : 1. What induces and maintains the different states in Nature ? and 2. What preserves these or metamorphoses them one into another ? the answer is that each of the four states of aggregation is brought about and maintained by one of the etheric formative forces, as follows :

The Heat state ... ... by Warmth ether,
The Gaseous state ... ... by Light ether,
The Fluid state ... ... by Chemical ether,
The Solid state ... ... by Life ether.

Chapter III

THE EARTH ORGANISM

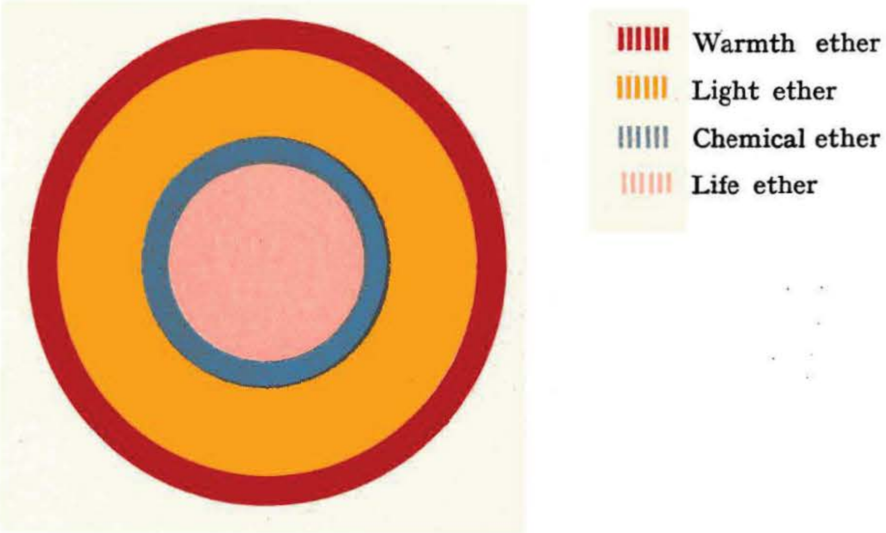
Its Structure and its Life Processes

WE can never understand the phenomena of cosmos and earth, of atmosphere, atmospheric electricity, and terrestrial magnetism, except as we view *the earth as a great living organism* which, like all living organisms, is characterized by a process of breathing, circulation, etc., in the manner in which these are now to be explained.

Whoever has read through many books of modern natural science dealing with meteorology, atmospheric electricity, thunder-storms, terrestrial magnetism, etc., will have found that the labour expended in these fields up to the present has resulted in the collection of a great abundance of material in dissociated parts, but that—as is generally confessed by the authors themselves—there is still wanting any system of thought which will clarify and integrate the numerous ill-assorted details of fact—a system in which these single phenomena may be reduced to harmony and order, or out of which they may be seen to have arisen. If we now arrange this scattered mass of single observed facts in the light of the teaching here set forth concerning the earth organism, the facts will be completely and reciprocally confirmed and—what is more important—they will be comprehensively interpreted.

Just as the so-called " atom "—or let us say, rather, the unit of substance—consists, as we shall see later, of four globular spheres, surrounding one another when in a static condition, which may be viewed as the spheres of activity of the four etheric forces, thus also the great earth organism—that is, the solid earth with its atmosphere—is so formed that it consists of four globular concentric spheres, and in each of these four spheres one of the four etheric formative forces named above is predominantly active.

The following diagram gives a sort of sketch of the earth organism during the static condition of its etheric forces as distributed according to their ruling principles.



The *suctional, inward-drawing,* forces of chemical ether and life ether have their principal spheres of activity, corresponding with their tendency, concentrated at the earth, with its component *solid* and *fluid* parts (oceans, etc.).

The *outward-tending,* centrifugal forces of light ether and warmth ether, on the contrary, have their spheres of activity primarily in the *gaseous* atmosphere surrounding the globe. This gaseous atmosphere is surrounded by a mantle of warmth ether at the outer borders of the atmosphere towards the cosmos (see pp. 61-62).

While the earth in its totality as an organism has the tendency to maintain this basic and normal arrangement of the forces (see diagram), the extra-terrestrial cosmic influences, and especially the sun influence, act upon this as upsetting, chaotic forces. The whole body of phenomena —atmospheric, meteorological, telluric—can, therefore, be understood only in the light of this mutual opposition, this conflict—on one hand, the tendency, the will, of the earth organism to bring about the fourfold stratification as a static condition, and on the other hand the action of the cosmic influences which will not permit this static condition to occur, but cause the layers mutually to whirl through one another and ever and again disturb the normal status of the earth structure.

Yet it is to this same chaotic dissolving, this upsetting of the merely terrestrial conformity to general laws, that we owe the phenomena of life on the planet Earth. Should the earth come to that state of rest toward which it strives—that is, harden, as it were, in the state normal to its general laws—then no life would be possible on it, for life actually requires chaotic dissolution, upsetting of the general laws tending to fixity. Just as, in the human and animal organism, the phenomena of life present in albumen and other organic substances arise from the breaking up and chaotic upsetting of the fixed normal and characteristic chemical states really basic to them (see Chap. XII), so also the life of the earth organism depends upon the continuous breaking up of its primal normal state of conformity to laws through cosmic influences, and especially those of the sun.

And just as the human organism during sleep, when it is no longer disturbed by the human ego active during the day in consciousness and will, re-orders and builds up during the night its systematic inter-relationship of forces as conformable to organic laws, so also the earth organism re-establishes by night the equipoise of its primal distribution of forces, upset during the day by the action of the sun.

So, then, that which the volitional soul activities of the human ego during the conscious life of the day signifies for the human organism, this also the sun signifies for the earth organism.

Out of the sublime eternal reciprocal play of day and night activities, chaos and order, summer and winter, near and distant sun, proceed all the atmospheric and meteorological phenomena.

The four etheric formative forces have also brought about naturally in their spheres of activity the states of aggregation and conditions of substance normal to these forces. Thus the inward-drawing forces of the chemical and life ethers, tending to concentrate, working in toward the centre of the earth, have produced the solid and fluid substances and assembled these toward the middle spheres of the earth organism; whereas the outward-striving, centrifugal forces of the light and warmth ether have produced the gaseous state of the earth's atmosphere and—in accordance with their tendency to strive outward from the centre—have in reality gathered this atmosphere in the outer part of the earth organism.

But the etheric formative forces, in their spheres of activity, not only work in the generation of the corresponding states of chemical inter-relationships and states of aggregation of substance—that is, in the formation and union of substances—but they work also as free forces in many other phenomena. Meteorology, the science of terrestrial magnetism, etc., have investigated individual instances of these under such designations as vertical current, potential gradient, barometric pressure, induction and emanation, etc., and we shall now see that all these single phenomena may be arranged under the great rhythmic process of the earth organism, for we shall learn that it is an organism not in mere theory, but in that it shows all the typical processes and rhythms of a living organism. It has its process of circulation, its breathing process—that is, it actually breathes, and we shall see how the results of meteorological investigation, hitherto not understood, articulate themselves organically into this harmonious process of life.

The Breathing of the Earth Organism

Goethe sought by observation of the barometer, most important of all instruments for this science, to reach a new conception of the connection between " barometric pressure " and atmospheric phenomena ; the rising and falling barometer, due to the changing " barometric pressure," he strove to trace back, not to influences outside the earth or accidental, but to forces acting rhythmically inside the earth organism. Dr. Rudolf Steiner wrote in this connection in his book " Goethes Weltanschauung "[*] : " Since, however, the height of the mercury depends on the pressure of the air, Goethe imagines that the earth alternately presses and again expands the whole atmosphere. If the air is compressed its pressure increases and the mercury rises ; the reverse takes place with expansion. Goethe ascribes this alternating contraction and expansion of the whole mass of air to a variation to which the attractive power of the earth is subject. He regards the increase and decrease of this force as inherent in a certain individual life of the earth, and compares it with the inbreathing and outbreathing of an organism."

If we follow up this thought in the light of the theory of ether previously stated, we shall find it completely confirmed by thought and observation. For the fluctuation of the barometer—that is, the fluctuating air pressure—does actually result from such a compressing force : namely, that issuing from the chemical ether. This brings us to one of the most fundamental problems of meteorology, which is important also for many other branches of science. In the increase of the so-called barometric pressure—that is, in the rising pressure of the atmospheric column upon the mercury in the barometer—that which induces the rise of the mercury does not come chiefly, as science has till now assumed, from a pressure which the atmosphere, through changes in its temperature, its volume, or otherwise, exerts of itself upon what is beneath, but it comes from the rhythmical tension and release of the suctional centripetal forces of chemical ether proceeding from the solid earth. This fact can now be shown variously in detail. If the suctional, centripetal forces of chemical ether, normally concentrated in the solid earth, extend their activity (as indicated in the diagrams following, pp. 52-53), out from the solid earth into those spheres also not normal to chemical ether but belonging to light ether and warmth ether—that is, the gaseous atmosphere—then this action, now pressing the atmosphere together by way of suction, comes to expression in the increasing barometric pressure and the rising barometer. If the chemical ether sinks back into its own sphere, down to earth, then the influence pressing together the atmosphere ceases, and the barometric pressure is reduced. We might represent what here happens, but only by way of comparison, in the following description. When iron filings lie in a space outside the field of a distant magnet, they will not be drawn by its attractive force; but, if we move the magnet toward that space until such space lies within the magnetic field, everything in that space will come under the control of the magnetic action. *The alternating barometric pressure is due in like manner to this: whether the earth organism sends its inward-drawing, suctional etheric forces above the solid earth into the atmosphere—that is, exhales; or draws these back into their own spheres of activity—that is, inhales.*

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[*] R. Steiner, " Goethe's Conception of the World." London, 1928, p. 178.

We shall see that this great breathing process of the earth organism is always carried out in rhythm, in the alternation of day and night, so that the same thing which man performs in one breath (inhaling and exhaling) *many times* each day is performed by the earth once in 24 hours, that is, in the manner indicated in the diagram on pages 52-53. We will here first only point out that there is actually a definite cosmic relation between the breathing rhythm of the earth organism and that of each individual man. A man who breathes normally takes 18 breaths in a minute, or (18×60) 1,080 in an hour, or (1,080×24) 25,920 in a day of 24 hours. Now, this number of human breaths in a day corresponds with the number of years that the sun requires in order to be at the time of the spring equinox once successively in every sign in the circle of the zodiac. To such cosmic rhythms, to which the earth organism is adjusted just as is the human organism, we shall later return; for the moment we must only indicate that the breathing rhythm of the earth organism is induced by the alternating activity of the same etheric forces that control the breathing of man (Chap. XII). As will be illustrated in later diagrams, the breathing rhythm of the earth organism—which expresses itself, and may be proved, by atmospheric pressure, barometric level, vertical current, potential gradient, humidity of the several strata, degree of induction of the air, degree of emanation of the earth, etc., etc.—depends upon the rhythmical alternation by which the earth organism exhales the chemical ether into the light-ether zone (the atmosphere) and then draws it back into the solid earth: that is, it depends upon the interchange between light ether and chemical ether, or, in other words, an expanding and a compressing force in the atmosphere, chiefly in the lower strata.

Before I proceed to establish the truth of this, it might be well to discuss briefly the views held by science up to this time as to these occurrences and their causes. The increase in barometric pressure and the rising barometer have been so conceived as if the column of air over the earth everywhere and also over the mercury in the barometer were a body possessing weight, " now thicker and heavier, now thinner and lighter," and as if, therefore, " the cause of this daily behaviour of the barometer were to be found in the daily variation of temperature. This last we may conceive, indeed, as a heat wave which moves round the earth with the sun."* But Professor Trabert himself points out in reference to this that the facts refute such an explanation, and asks: " How does it happen that, although in the case of the temperature a single wave predominates, yet, in the matter of the barometric pressure, the chief phenomenon is the double wave ? " It is evident, then, that the course of the barometric pressure does not, in its essential rhythms, follow the rhythm of the heat-process.

Heat-processes travel in a single wave and, since they are to be traced back to the action of the sun, have naturally their one maximum at midday, their one minimum at night. Were the phenomenon of barometric pressure dependent upon the heat-processes, the former would have to travel in the same rhythm and have its maximum and minimum at corresponding times. This, however, is not at all the case in either respect. The maxima and minima show exactly the opposite course from what they would have to show according to the above hypothesis, which scientists have endeavoured to uphold with the help of other hypotheses. We have at midday in reality an unquestionable minimum, and in the morning and evening, about the times of sunrise and sunset, the maxima of barometric pressure. This is the well-known double wave, of which Professor Trabert, in his very lucid book already cited, " Meteorologie " (p. 65), says that it is " *the characteristic of the course of barometric pressure, a regular double daily wave! Whence does it come? The most distinguished physicists and meteorologists have laboured in vain to explain this. . . .*"

But, if we apply the description of the distribution of the four etheric formative forces as given above to this fundamental phenomenon, we obtain a complete and indisputable explanation. Indeed the twofold wave of air pressure, its maximum and minimum, could not occur otherwise than they actually do in the light of the following description of the breathing process of the earth organism.

In order to be able to introduce the data of specific scientific research as proof of the activity of the etheric formative forces, here stated to be fundamental, special value is attributed to two factors which reveal themselves both to observation and to experiment:

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* W. Trabert, Meteorologie (re-edited by Dr. A. Defant), Berlin, 1918, p. 66.

1. *Maxima* and *minima*.
2. *Increase* and *decrease* in the several components—atmospheric electricity, terrestrial magnetism, etc.—*with the increasing altitude*, or distance from the surface of the earth.

Special importance was attached to the observation of the barometric pressure for the reason that a great many of the causative factors in this phenomenon stand in direct relation to the other meteorological elements.

We must have clearly in mind with what a tremendously important phenomenon we are here dealing, what profound significance there must be for all the phenomena of life on the planet Earth in the fact that the earth-enveloping air, in which we live and breathe, is compressed together and again expanded in a mighty rhythm in the course of each day.

We have said that the rhythmic change in barometric pressure is due to the fact that the suctional, inward-pressing forces of the chemical ether, normally centralized in the solid earth, are exhaled, as it were, into the atmosphere (in the morning), and thus extend to these strata into which they penetrate their suctional inward-pressing action ; and likewise are (in the evening) inhaled again into the earth organism. As this breathing rhythm occurs once in a day of 24 hours, therefore these suctional inward-pressing forces of the chemical ether pass an observer standing on the surface of the earth twice in a day, once in the exhalation into the atmosphere, the second time in the inhalation back into the solid earth (diagram pp. 52-53). The human observer,* therefore, in the lowest atmospheric stratum of the earth will be able to recognize twice each day the action of the chemical ether in producing this air pressure : that is, when the chemical ether rushes past him in the morning, exhaled from the solid earth into the atmosphere, and in the evening when it rushes past him again, being inhaled back into the solid earth. This is, in reality, the " double wave " for which physicists and meteorologists seek an explanation.

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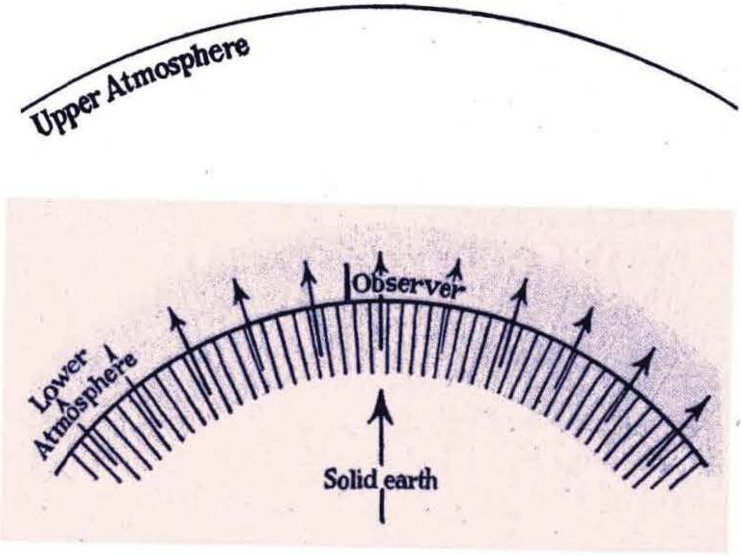
* We beg that the reader, in examining these diagrams, will not think of the theoretical observer often imagined as floating out in space, but naturally entirely non-existent, but that he will think, rather, of an actual man on the surface of the earth.

Breathing of the Living Earth Organism

I

Exhalation begins during and after sunrise.

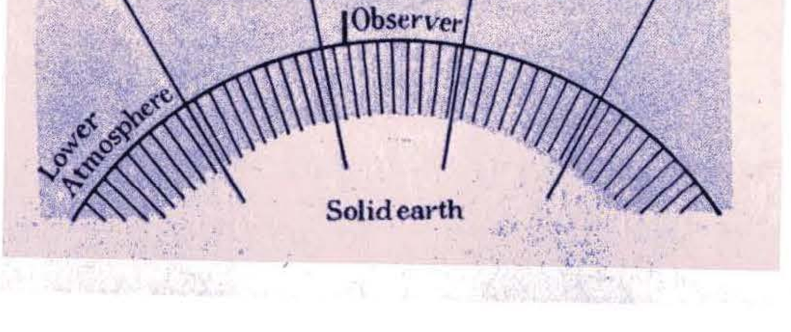
▥ Chemical ether


Upper Atmosphere
Observer
Lower Atmosphere
Solid earth

II

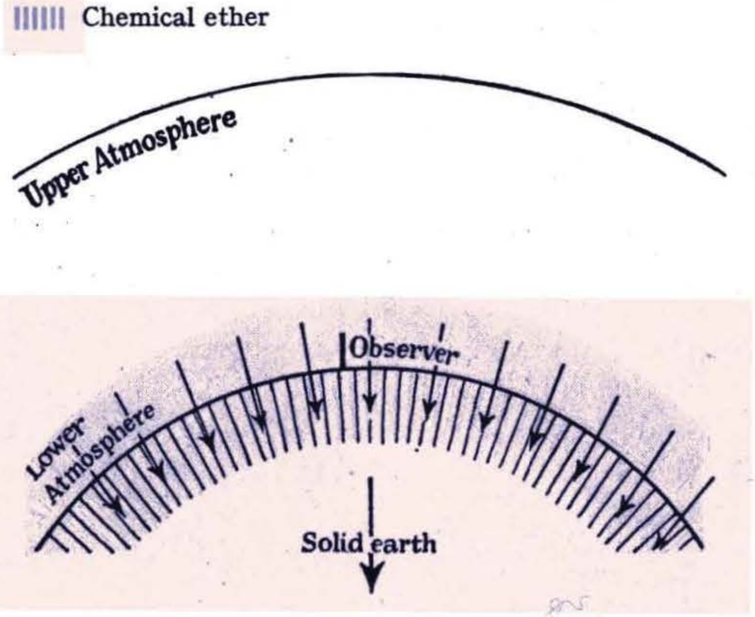
Exhalation process is completed during midday and in the afternoon.

▥ Chemical ether


Upper Atmosphere
Observer
Lower Atmosphere
Solid earth

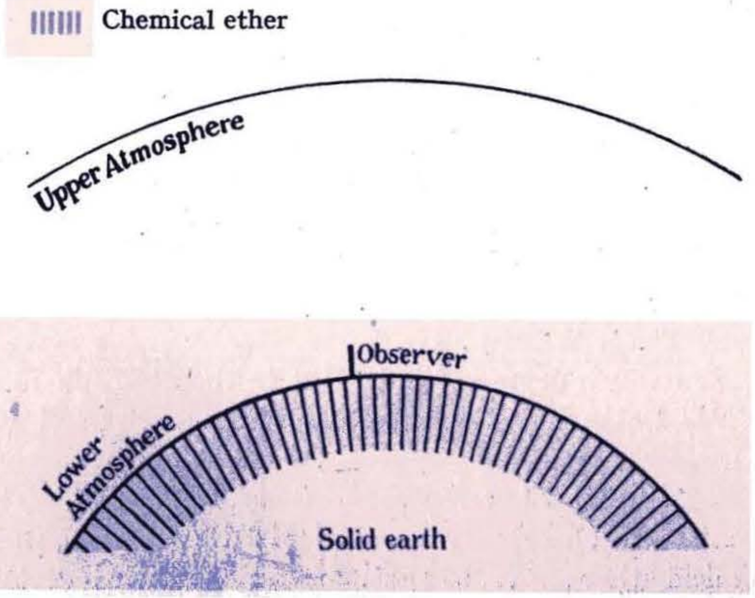
III

Inhalation begins towards sunset.


||||| Chemical ether
Upper Atmosphere
Observer
Lower Atmosphere
Solid earth

IV

Inhalation process is completed during night, 3-4 o'clock.


||||| Chemical ether
Upper Atmosphere
Observer
Lower Atmosphere
Solid earth

In detail this breathing of the living earth organism takes its course in the following way (observe here the above diagrams) :

Exhalation during and after sunrise :

All rushes outward from the solid earth past the observer on the surface. The suctional ether forces, still concentrated, course through the lowest atmospheric strata.

Maximum in the vertical current, especially in summer.

(The elements of atmospheric and terrestrial electricity are drawn upward by the great breathing process.)

Maximum in the potential gradient, especially in summer.

Maximum in barometric pressure in the lower atmosphere. (The chemical ether passes by the observer.)

Maximum of humidity in the soil.

Gradual *increase* of the humidity in the upper air strata. (The chemical ether is adapted to the fluid state of aggregation. See Chap. II).

Gradual *increase* in the degree of induction of the higher strata.

Gradual *decrease* of the emanation grade of the earth (as it has been radiated out from it).

Air in upward motion.

" Reversal of temperature " begins, chemical ether with cold going upward, sun's rays with heat going downwards. (The special explanation of this will be given on pp. 62-63.)

Exhalation process is completed, at midday and just after.

Nearly static condition, as at night. The suctional forces are scattered widely in the atmosphere and hence are very weak.

Minimum vertical current.

Minimum potential gradient.

Minimum barometric pressure in the whole atmosphere (3 o'clock p.m.), chemical ether most widely scattered.

Maximum humidity in the atmosphere (produced by chemical ether, since the fluid state of aggregation is subject to this ether. See Chap. II).

Maximum degree of induction in the atmosphere.

Minimum degree of emanation of the earth (having radiated out).

" Reversal of temperature " is completed. The earth organism is chaotically revolutionized (warmth ether below, chemical ether above, so that, contrary to their individual basic structure, the spheres of the etheric forces are thrust into one another).

Maximum vital activity.

Inhalation toward sunset:

All rushes again to the solid earth, past the observer. The suctional forces, concentrating, course back through the lowest atmospheric strata on their way to the inside of the solid earth.

Maximum vertical current.

Maximum potential gradient.

Maximum barometric pressure in the lower atmosphere (chemical ether going again past the observer).

Maximum humidity at the surface of the earth (The fluid state of aggregation is subject to chemical ether. See Chap. II).

Gradual reduction of humidity in the higher strata, from the movement of the chemical ether downward.

Gradual reduction of the degree of induction of the upper strata.

Gradual increase in the degree of emanation on the surface of the earth (gathered together there again).

Air in downward motion.

" Reversal of temperature " begins again ; warmth ether rushes upwards, chemical ether with cold and humidity downwards (see p. 64).

Inhalation process is completed, during night, 3-4 o'clock.

All is concentrated in the solid earth ; and the etheric forces have returned to their own spheres.

Minimum vertical currents.

Minimum potential gradient.

Minimum barometric pressure.

Minimum humidity in the atmosphere (especially in the upper atmosphere ; if the breathing process is not entirely completed, there may still be some degree of moisture near the soil).

Minimum degree of induction in the upper atmosphere.

Maximum degree of emanation of the earth (there gathered together).

" Reversal of temperature." The earth organism has its basic form : warmth and light ether above ; chemical and life ether below.

Minimum vital activity.

As the expert will see from the table, a great many other phenomena find here a complete and harmonious explanation.

We have seen, in the chapter on the states of aggregation, that the chemical ether causes the fluid state of aggregation. In the table above we can now follow the wandering of the chemical ether out of the solid earth into the atmosphere and back again in the course of a day, and through experiments in measuring the moisture content in the lower and upper strata of the atmosphere as well as in the soil at varying times of day, we shall be able to follow the chemical ether in its rhythmical activity of creating moisture. Both dew and mist in the morning and evening are also the results of the moisture-producing activity of chemical ether, because in the morning and evening this reaches its highest state of concentration in the lowest levels of atmosphere and at the surface of the earth. The earth organism, then, may be said to breathe in and out, along with the chemical ether, also the moisture-producing elements in rhythmical alternation.

The Relation of the Earth Organism to the World of Living Plants

It may be well to call attention here very particularly to another phenomenon which has the utmost significance for the processes of life within our earth organism: the rising and falling of water in trees, in the plant world everywhere. For this process, which is the very fundamental pre-requisite for all the vegetation of the earth, no explanation has ever been found, since the mechanistic conception of " the pressure of osmosis " in the plants has been proven to be false by the evidence that this " pressure " is far too slight for the occurrence under consideration. The fundamental error is made here which occurs also in the consideration of the human organism (Chap. XII), that of seeking to understand a plant according to the laws of a mechanism, and therefore giving less and less attention to its articulation in the living organic totality of the earth and the cosmos (for example, in the case of the pressure of osmosis). And there has been in addition the one-sidedness through which, on the basis of materialistic-mechanistic philosophy, only the physical, and not also the etheric and higher principles, are brought under observation (see Introduction).

In reference to the rising and falling of water in the vegetable terrestrial world, Professor A. Hansen says rightly in his book " Die Pflanze "* (p. 84): " There is a great gap in our understanding due to the entire absence of any insight in regard to the energy which must come into play in the lifting of water into the trees."

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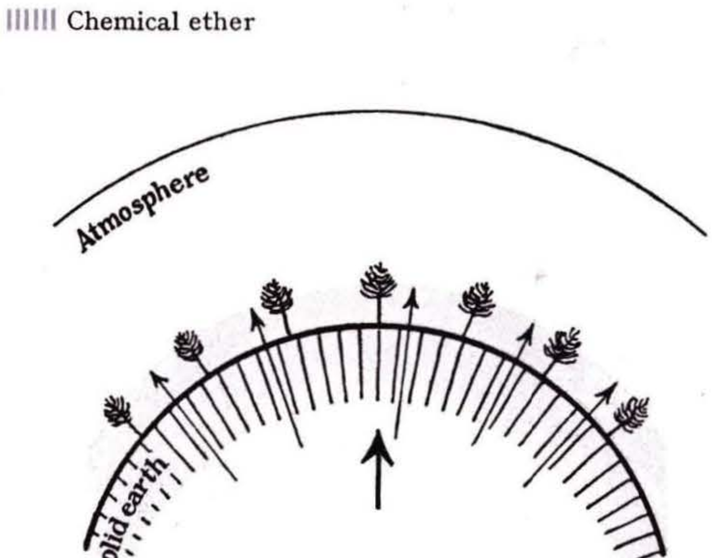
* Berlin, 1914.

But this very occurrence is the most important of the primal phenomena in the life-processes of the plant world. The sprouting, shooting up, and development of plants in the spring, their withering and dying in autumn, are a direct result of this dominant rhythm which the watery element in the earth organism carries through in the course of a year. So long as there is no understanding of the cause of this process, there is no foundation for an understanding of the phenomena of life. When, however, we enter concretely into the action of the etheric formative forces and into the rhythm of breathing which the living earth organism carries on with them, this primal phenomenon will become visible and intelligible to us.

The occurrence is, as represented in a diagram, the following:

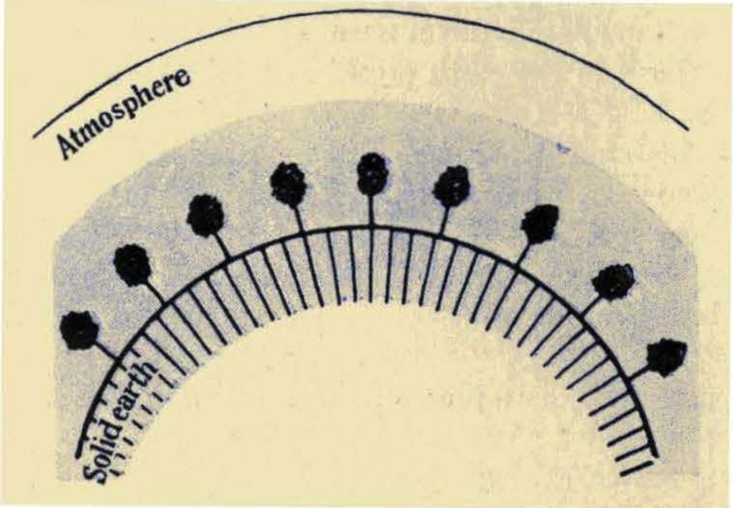
Spring



The beginning of the influence of the sun breaks up the fundamental inter-relationships of the etheric earth. The chemical ether rises out of the solid earth into the atmosphere, is exhaled from the earth organism, forming moisture and dragging this upward with itself. The water rises in the trees, vegetation begins.

Summer

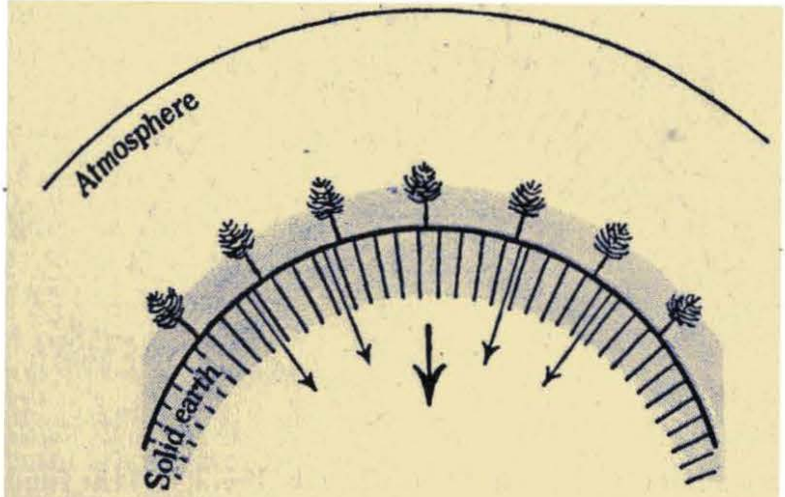
||||| Chemical ether



The structure of the etheric earth is completely upset. The earth lives and wakes, the chemical ether has passed over, been exhaled, to the maximum degree into the zone of light ether of the atmosphere : the culmination of vegetable life.

Autumn

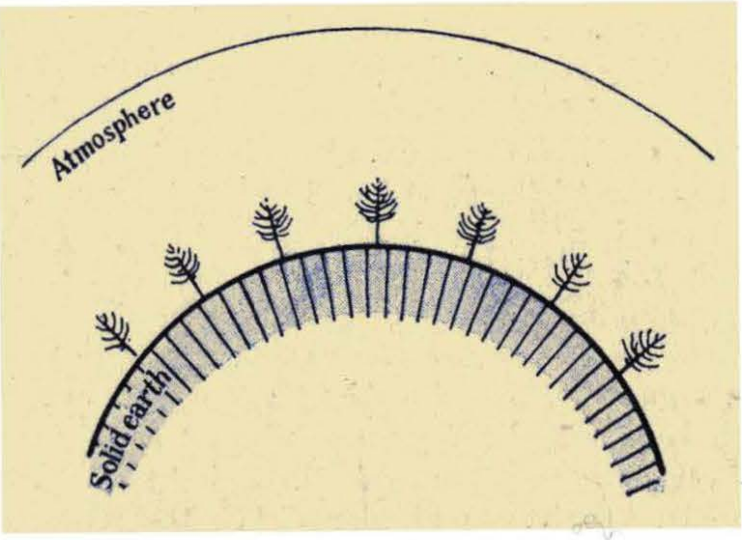
||||| Chemical ether



The chemical ether of the earth organism, which has been creating moisture and bearing the watery substance along with itself (see Chap. II) is drawn slowly back into the solid body of the earth organism. The water in the trees descends. The leaves dry up. Minimum processes of vegetation in the trees.

Winter

||||| Chemical ether



The earth has reached its normal basic system. The chemical ether is for the most part concentrated in the solid earth, inhaled ; the life-producing, dissolving influence of the sun is at its lowest. The earth seeks to rest in its normal etheric structure.

Just as the breathing rhythm of man, as shown above, stands in direct relationship to cosmic processes, so also the life-process of the vegetable world repeats the great breathing rhythm of the etheric earth in several graduated rhythms. In the course of the year, as the etheric forces of the earth organism begin to expand outwards with the spring, the water begins to rise in the plant world ; vegetable life begins as a result of the breaking up of the etheric basic structure of the earth-organism, which has become fixed during winter. The shooting up of the plant world into its forms at the time of the expanding process in Nature is a result of the chaos induced—that is, the coming together of the normally separated etheric formative forces. We shall see in Chapter XI not only that the etheric formative forces of the earth-organism are active in the rising of the water in the plant world, but that certain etheric formative forces combine in activity also in the individual shaping and forming of the plant world, and that here again we are not dealing with a merely mechanical process as the mechanistic philosophy might again maintain. This process of expanding and shooting up into forms in the spring stands in direct contrast to the concentration of the etheric formative forces in the solid earth during autumn, which is accompanied by the descent of water in the plant world and by a very wide-spread loss of forms among plants. This again is not merely a mechanical process. It is a result of the rhythmical etheric activity of breathing of the earth organism.

Along with the great yearly rhythm in the plant world, goes the daily rhythm already described, which, in the alternation of day and night, maintains, by means of the inhaling and exhaling of parts of the chemical ether at brief rhythmical intervals, the movement of water in the plants, and all that is connected with this—that is, maintains life.

A third rhythm of the plant world was first observed by Goethe, as indicated in his noble words concerning the " metamorphosis of plants." This rhythm which rests upon a threefold expanding and contracting process in the growth of a plant can be discovered, however, solely when we look upon the plant world, not with the eyes of a mechanistic dogmatism, but with the eyes of one who experiences the organic metamorphosis of living forms with an equally living vision. Dr. Rudolf Steiner has set forth this rhythmical movement of growth with wonderful descriptive power in his work "Goethes Weltanschauung."* The state of contraction, concentration, in a seed first passes over into an outward expansion when the plant develops out of itself the first organ, the cotyledons, forcing these outward by successive impulses. In the second period of growth, there follows on the contrary an inward concentration. Goethe says :†

Less abundantly yielding the sap, contracting the vessels,
So that the figure ere long gentler effects doth disclose.
Soon and in silence is check'd the growth of the vigorous branches,
And the rib of the stalk fuller becometh in form.
Leafless, however, and quick the tenderer stem then upspringeth,
And a miraculous sight doth the observer enchant.
Rang'd in a circle, in numbers that now are small and now countless,
Gather the smaller-siz'd leaves, close by the side of their like.
Round the axis compress'd the shelt'ring calyx upfoldeth.
And as the perfected type, brilliant-hued coronals form.

Dr. Steiner comments on this : " In the calyx the plant-form draws itself together and in the corolla again spreads itself out. The next contraction follows in the pistils and stamens, the organs of generation."‡ The threefold rhythm of expansion and contraction in the course of the year is completed, and can begin again the following year in the germ. We are here dealing with an activity of the etheric formative forces, and their tendency to expand and contract, where their differentiating and form-creating activity begins—that is, a spiritual activity entering into the world of substance. In a later discussion of the form-creating forces (Chap. XI), we shall be able to observe this in detail. Here we need only point out that, for those who would understand and interpret in a purely mechanical fashion the all-embracing activity of the great rhythms of the etheric formative forces within the earth organism the real and scientific investigation of the phenomena of life will always remain impossible.

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* English edition, " Goethe's Conception of the World," 1928.

† Translation by E. A. Bowering, The Poems of Goethe, London, 1853.

‡ loc. cit., p. 112.

The Circulatory Process of the Earth Organism
The Reversal of Temperature

We shall undertake here in particular to explain, on the basis of the distribution of the etheric formative forces of the earth as already set forth, two exceedingly important phenomena, which require for the science of meteorology a more exact interpretation—the so-called " reversal of temperature " and the true origin of the rotation of the earth on its axis.

We have said that, in their normal structure, the etheric formative forces of the earth are so associated that, when the earth establishes her basic concatenation, the warmth ether encloses the terrestrial atmosphere as the outermost sphere—that is, that the earth as a whole is surrounded by a heat mantle. The findings of scientific investigation up to the present have generally not yet reached this important conclusion, but they have confirmed the several facts separately. Professor Wilhelm Trabert, in his very interesting book " Meteorologie," already cited, says : " Up to the altitude of eight kilometers, the higher one mounts the more rapidly does the temperature fall. But from ten kilometers on, we observe again a rise in temperature or an isothermic stratum. Beyond eleven kilometers, the temperature seems to be almost constant, or to rise very slowly." This conjecture of meteorology in regard to a gradual rise of temperature in the highest atmospheric strata, is now completely confirmed by the facts stated above—that the earth possesses a heat mantle over the outermost limits of its atmosphere, as corresponds with its structure shown on page 46.* This fact, indeed, is further confirmed by the phenomenon of the so-called " reversal of temperature," which is of the utmost importance for the life processes within the earth organism.

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* The following results of the most recent scientific experiments in this field were reported in the press, February, 1926. " Research in the atmospheric strata at an altitude of 150 km. The Moscow Institute of Astro-physics has completed its researches in the upper levels of the earth's atmosphere. The research has been carried out with the help of a special apparatus for photometry of the upper strata constructed by the Director of the Institute, Fessenkow. The Institute succeeded in determining the structure of the atmosphere to an altitude of 150 km. It was determined that the density of the upper strata is almost one hundred times greater than has hitherto been supposed. This proves that, contrary to the prevailing opinion, the temperature of the very high strata is higher than that of the lower strata. Perhaps, the freezing point is reached at an altitude of 60 or 70 km., and thereafter the temperature rises. The Institute investigated the atmosphere by systematic observations of the twilight up to the beginning of night. The results of these investigations were confirmed by those of English scientists carried out entirely differently—that is, by observing the fall of meteors."

These experiments thus afford a supplementary confirmation of the facts given years ago as a result of research in spiritual science by Dr. Steiner and used as the basis for the theory of ether and of the earth organism here set forth.

The fact is that, while by day the temperature falls in the lower atmospheric strata with the increase of altitude, yet " by night and in winter," as Professor Trabert says, " the temperature rises with the increase in altitude."

We have, therefore, to observe the following interesting occurrence in the atmosphere :

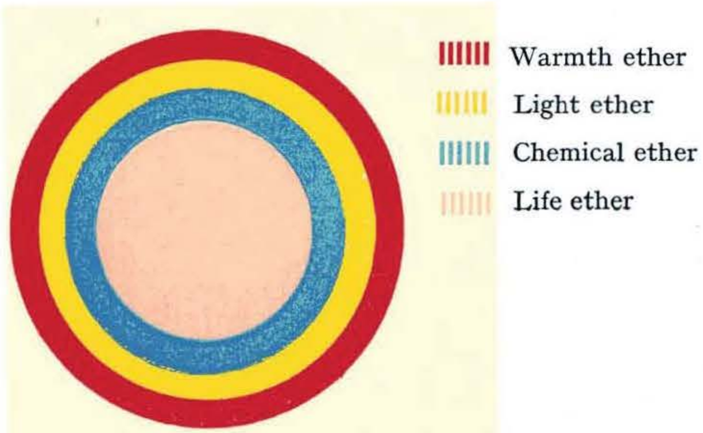
By *day, fall* in temperature with increase in altitude.

By *night, rise* in temperature with increase in altitude.

This unique phenomenon can be understood, systematically and in its significance, in no other way than on the basis of the etheric processes within the earth organism. We must bear in mind that, according to the breathing process of the earth organism, as described on page **51** in relation to the subject of barometric pressure, the chemical ether rushes to the solid earth at night, when the earth seeks to establish its basic structure. But then the warmth-ether, which according to the earth structure belongs above, has just the opposite tendency on account of this process : that is, to rush from the solid earth back to its own sphere of activity in the outermost parts of the atmosphere.

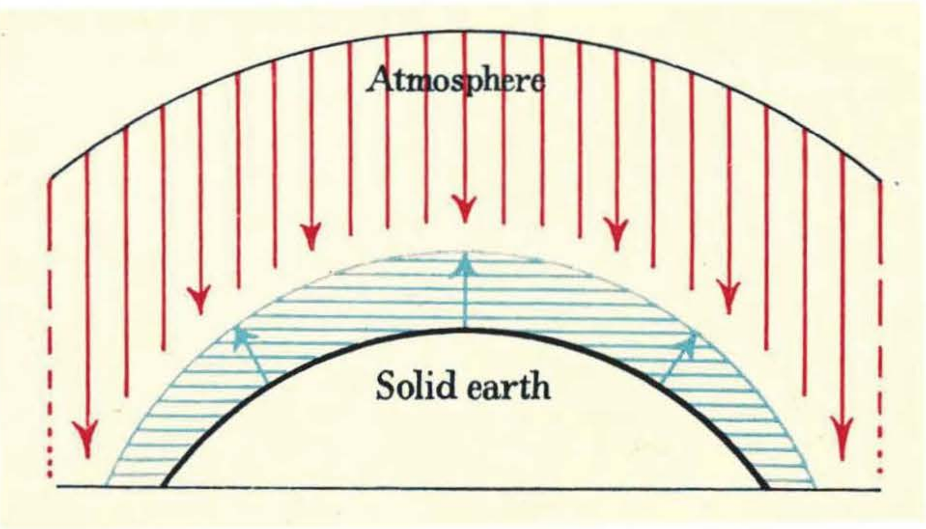
Therefore, we have the following rhythmical circulatory process of heat within the earth organism (the " reversal of temperature ").

Night :



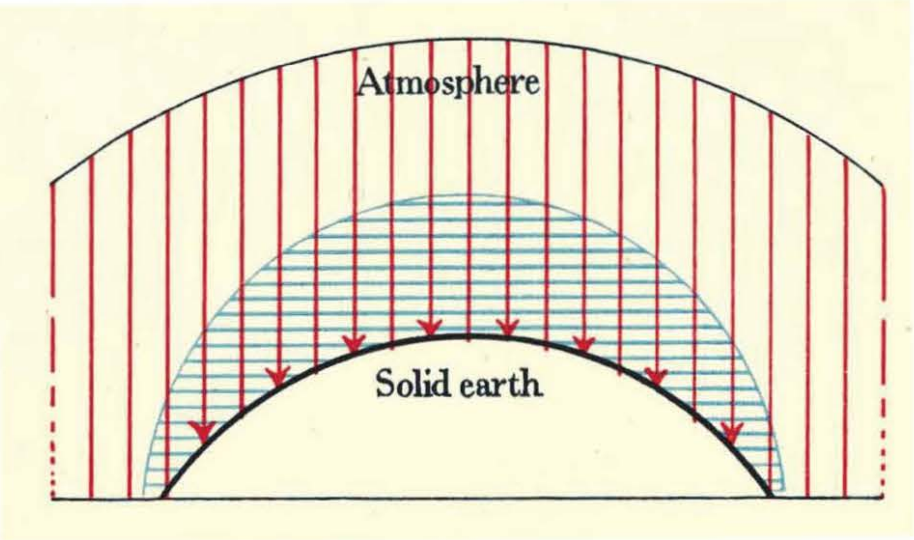
Basic structure of the earth.
(Diagrammatically represented for the whole earth.)

Morning :



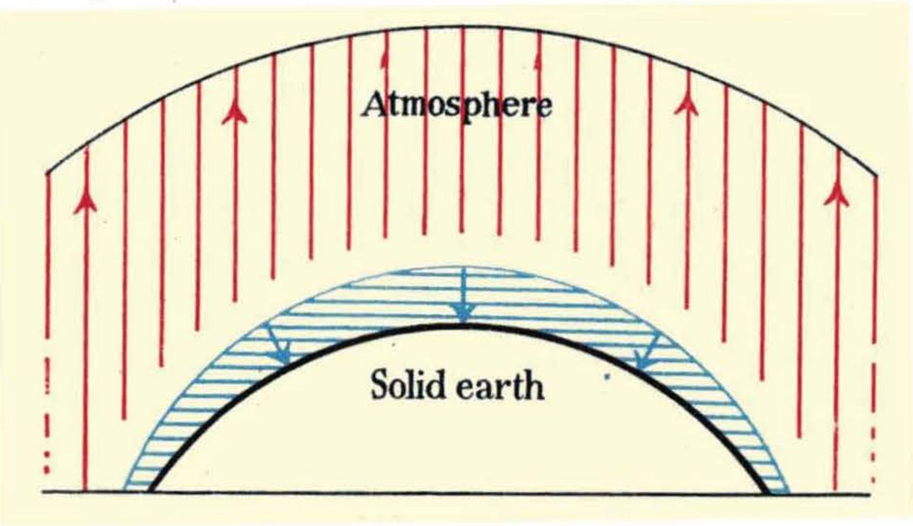
The action of the sun reduces to chaos the structure of the earth, bringing the warmth ether out of its own sphere, from above down below to the solid earth. The chemical ether passes out of its own sphere, from below upward.

Midday :



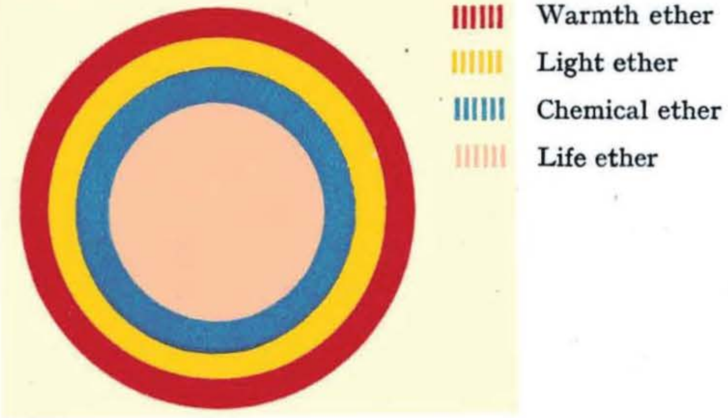
The process is completed whereby the warmth ether is gathered upon the solid earth, the chemical ether interpenetrates the atmosphere and thus the etheric basic structure of the earth is reduced to chaos : the earth wakes and lives. Climax in processes of vegetation. The temperature at the surface of the earth is at its highest, and *decreases with increased altitudes.* The solid earth has its maximum of warmth.

Evening :



Sunset—the earth seeks to restore during the night its etheric basic structure—that is, the warmth ether rushes upward, the chemical ether downward : both of them thus going to their own spheres of action. *The beginning of reversal of temperature.*

Night :



The process is completed. The earth organism has again restored its fundamental arrangement. The reversal of temperature is complete—that is, it is warmer above than below.

From this reciprocal rushing past one another of the warmth ether and the chemical ether (and naturally, to a certain extent, the other two kinds of ether also) comes the explanation both of the maxima of the vertical current, which at sunrise and at sunset moves perpendicularly toward the surface of the earth, as well as the simultaneous maxima of the potential gradient, which is only a specific expression of the shifting and mixing and separating processes of the etheric forces. As is visible in the tables given on p. 54, the increase in the degree of emanation at the earth's surface by night and the minimum of this by day, following the inhalation process of the earth by night and its exhalation into the atmosphere by day, become intelligible ; and finally also the reversed behaviour of the degree of induction in the upper atmosphere by day and night is reduced to system. Meteorology has been in confusion in reference to the direct inter-dependence of all these factors, some authorities affirming and others denying this. But a systematic testing and co-ordinating of these with the great breathing and circulating processes of the earth organism we have discussed gives throughout the inner harmony of all these factors. Unfortunately, it is not possible to go into the exceedingly interesting details of all these organic processes ; this must be reserved for special treatment, since here we shall first indicate the great inter-relationships and their causes.

The Rotation of the Earth

From what has already been said, an explanation of the true nature and true causes of the rotation of the earth can now readily be given. Scientific research has not, up to the present, been able to reach any clear conception of the causative factors of the earth's rotation, because, unfortunately, it was not yet possible to reach a systematic conception of the phenomena of terrestrial magnetism and of the electric and etheric currents encircling the globe. Only such a systematic conception will render possible the understanding and comprehensive grasp of the one phenomenon on the basis of the others, so as to penetrate to the very foundation causes of all these occurrences intimately connected with the rotation and the structure of the earth.

Indeed, in reference to the terrestrial current, Professor A. Nippoldt says in his very lucid, comprehensive work, " Erdmagnetismus, Erdstrom, und Polarlicht "* : " Our knowledge of the terrestrial current is still exceedingly slight ; not even the necessary observations are available." In the effort to explain the electric and magnetic currents " induced "—or existent—in the earth, the hypothesis has been set up of a cosmic current encircling the earth at a great distance " in a circuit whose diameter is a multiple of the diameter of the moon's orbit " (Nippoldt, p. 128), and supposed to be the ultimate cause of the most varied terrestrial phenomena. Yet this hypothetical current quickly proved to be quite contrary to other hypotheses in this field, and, therefore, as highly improbable, but in any case, when we place the causes of this phenomenon outside the earth in an altogether unknown source of force of questionable existence, we at once begin again that " regressus ad infinitum " of which we spoke in the introduction : the everlasting question concerning the cause of the force which generates motion, and the like.

* 3rd edition. Berlin, 1921.

The rhythmic processes of the *living earth organism* itself, on the other hand, direct us to the way. *In order to explain the rotation of the earth on the basis of activities within the earth itself, one must simply conceive of the earth, not as a dead body, but as a living organism.* This is generally readily admitted in a theoretical way in connection with the observation of life-processes on the earth ; but it is often just as quickly forgotten again in the further practical application of thought ; so that—under closer attention—there generally remains behind a conception of the earth as a dead mass of matter which moves on its own axis and in the cosmos after the manner of a dynamo driven by forces of unknown derivation. This startling and false mechanical sort of view will come very speedily in this fundamental field of knowledge to its " ignorabimus."

We have seen that the living earth organism carries on, with its etheric formative forces, a process of breathing and of circulation, which comes to expression chiefly in the exhaling and inhaling of the forces of chemical ether from the solid earth on the one hand, and on the other in the flowing of warmth ether downwards and then again upwards. Between these two processes there is a fundamental distinction, the nature of which is of decisive significance for an understanding also of other cosmic and terrestrial processes. That is, while the warmth ether is induced by the direct influence of the sun to flow down through the atmosphere even to the solid earth, the exhaling and inhaling of the forces of chemical ether, on the other hand, constitute an occurrence which—although caused indirectly by the sun, like everything in the cosmos—is, however, *carried out directly by the earth organism itself.*

We have already seen that the breathing of man, that of the earth organism, and the time required for the passage of the sun successively through each sign of the zodiac at the moment of the spring equinox stand in a cosmic numerical relationship—that is, that the time required for the passage of the sun at the spring equinox through the signs of the zodiac is 25,920 revolutions of the earth around the sun, and that one breathing of the earth organism (in a period of 24 hours) corresponds to 25,920 breaths of a man. If we observe now the human organism as regards its rhythmic system, we see that man has no direct influence upon the circulation of his blood, but that he has a direct influence upon his breathing, although he does not usually exercise this influence, but gives himself up to the general rhythm (Chap. XII). For any one can at any moment by action of his own will change the rhythm of his breathing, but not that of the circulation of his blood. The intimate relationship, therefore, which the human ego and its will bears to man's breathing, in contrast with the very much stronger control of other influences over the circulation of the blood, reveals to us the reality of the resemblance between these facts and the other fact that the breathing rhythm of the earth organism is caused directly by the earth itself and only indirectly by cosmic influences, while, on the other hand, the process of circulation of the warmth ether is due directly to cosmic forces outside the earth. These truths, of extraordinary breadth of significance, can naturally only be pointed out here ; and it must be left for the present to each one to follow out this connected group of facts to their significant consequences.

In the following diagram (p. 68) is shown the etheric structure of the earth at midday—that is, when the exhalation process has been carried out. The entire space between the solid earth and the outermost atmosphere—that is, the spheres of warmth ether, light ether, and chemical ether—are interpenetrated by warmth ether ; but at the same time the atmosphere is also interpenetrated by the exhaled chemical ether. The basic structure is, therefore, reduced to chaos ; the earth is awake. During this time, accordingly, that part of the earth organism turned toward the sun is, as it were, saturated in all its spheres with warmth ether (see diagram p. 68).

While in this way that half of the earth organism, with its etheric and vegetable components, which is turned toward the sun is passing through the process described, *the other side, at the same time turned away from the sun,* re-establishes the basic structure of its strata ; this side is, therefore, as it were, unsaturated by the etheric forces necessary to its vital process. What now happens is simply the result of that which is so characteristic of all organic bodies—*heliotropism, the eternal striving toward the sun.* Just as plants always systematically turn again toward the sun and induce in their physical bodies the requisite motions directed toward the sun, impelled from within, in order to grow toward the sun by the shortest way, and just as the most recent researches have shown beyond dispute the same heliotropism in the case of animals of the most varied kinds (which, indeed, respond selectively to definitely determined rays of light), so does the part of the earth organism which is not saturated with the warmth ether of the earth and life ether of the sun (see diagram) strive to be exposed to the action of the sun (heliotropism), while the part of the earth organism which has been reduced to chaos, saturated with the etheric forces, strives to restore its static basic complex undisturbed by the action of the sun.

The rotation, therefore, is not the result of a mechanical driving of the dead earth body by forces of unknown origin ; *but the rotation of the solid earth is a natural result of the rhythmical processes within the etheric formative forces of the earth organism itself*—that is, the etheric formative forces which in their rhythmical action call forth the phenomena of life in the earth organism also induce the rotation necessary for this purpose on the part of the earth body, formed, maintained, and vitalized by them.

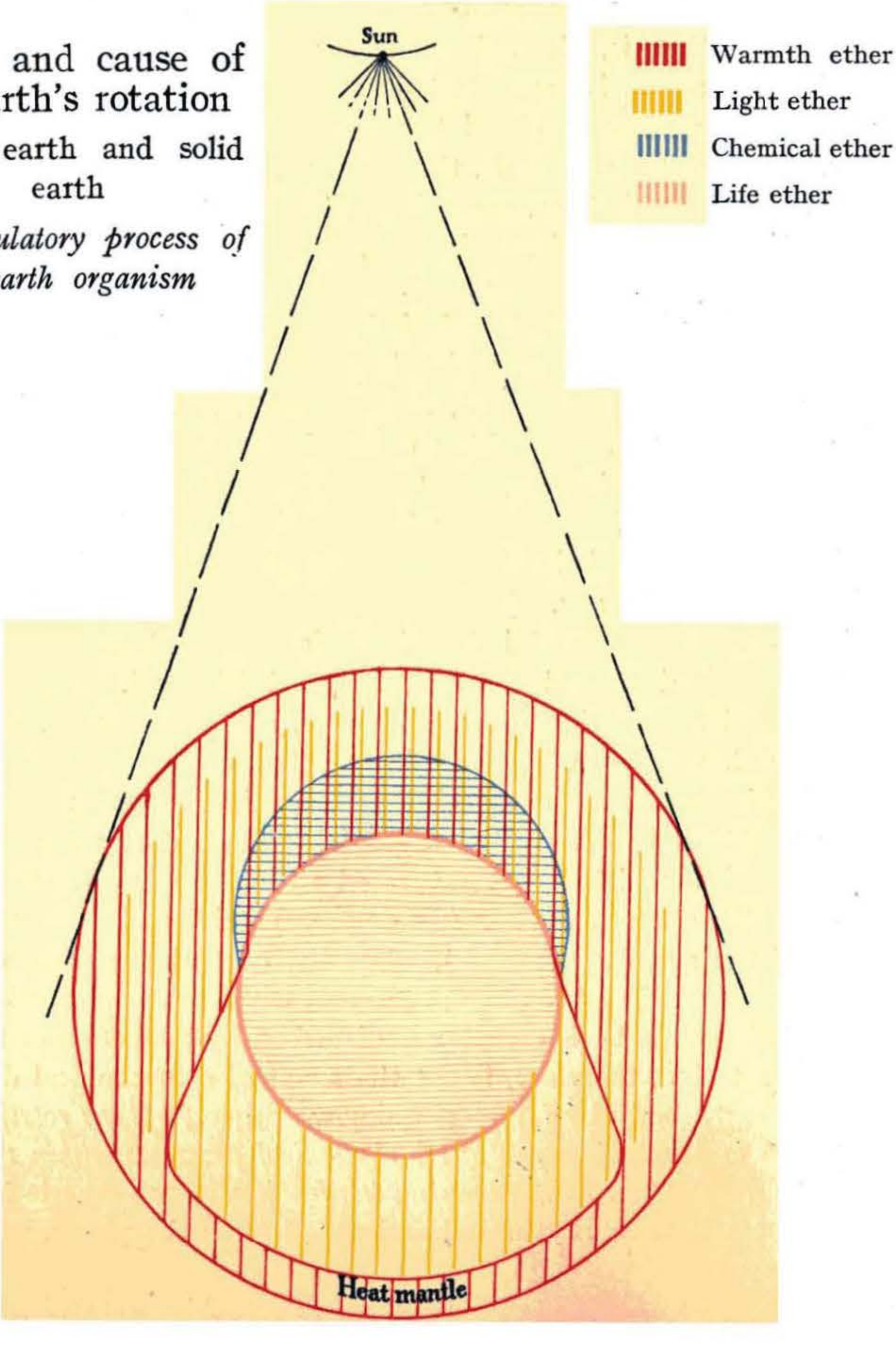
Just as blood circulates through the human organism, warming and vitalizing it, so also does the warmth ether, saturating part by part the earth organism, circulate around the rotating earth body, keeping it alive. The "warmth-night" and "warmth-day" thus alternate as a rhythmical result in the different parts of the earth organism. The rotation of the earth can be understood only if *we know that it is the etheric earth which induces this rotation of the solid earth,* and not the reverse.

These phenomena are illustrated in the following diagram:

Nature and cause of the earth's rotation

Etheric earth and solid earth

The circulatory process of the earth organism



The Etheric Currents in the Earth Organism

We shall now concern ourselves somewhat more thoroughly with the etheric, terrestrial-electric, terrestrial-magnetic, and other currents coursing through the earth organism, since these will be of decisive importance for a future consideration of man, animal, plant, and mineral.

In the remarkable and lucid scientific work of Meyer and von Schweidler, " Radioaktivität,"* I have discovered a passage the thought-content of which—if it be not relegated in merely theoretical fashion to an uncertain future, but introduced practically into the scientific investigation of the present—must bring to realization that which has not only been postulated in concrete form by the spiritual science of Dr. Rudolf Steiner, as oriented by Anthroposophy, but also taken as the orientation of view for many branches of science. The passage reads (p. 20): " Perhaps, we may be permitted to think that the human organism continually receives ' electrons ' out of its environment and, under the influence of light and heat gives these up again ; perhaps, the near future will permit us to speak of a ' circulation of electrons ' out of the environment into man and back again into the environment, concerning whose effects upon our vital processes we as yet have not the slightest intimation." I should fear that the two bold investigators of radio-activity would not make themselves very popular among certain of their colleagues in the faculties of medicine, biology, etc., through this scientific postulate, although it rests, in fact, entirely upon a truth. But I must confess also that this sceptical hope of the two investigators of radio-activity, so carefully hemmed in as it is with " perhaps," actually shocked me as I thought that the very thing which Professors Meyer and von Schweidler claim and hope for some indefinite future was already taught and applied in a great many fields of scientific research by Dr. Steiner many years before the appearance of that book concerning radio-activity, and that, because of that scientific dogmatism so characteristic, unfortunately, of our time, only now do this teaching and its results begin to influence fruitfully the scientific world. Only historical parallels in the fate of those who have given a new direction for men's conceptions of the world can allay one's distress over this sad fact.

In reality, constant currents stream, not only through men but also through animals, plants, and minerals, and we shall here concern ourselves concretely with these. In order to arrive at a clear conception of the most elementary principles involved, it may be well for me first to bring forward here a fact which has never, unfortunately, been set forth and emphasized in its exceedingly broad bearing upon the phenomena of life : that is, that the maximum effect of the sun's rays is exerted when the sun is in the zenith—in other words, when its rays stream down toward the centre of the earth vertically, perpendicularly to the earth's surface ; whereas the maximum effect of the moon's rays is received when the moon is on the horizon—in other words, when its rays pass horizontally over the surface of the earth.

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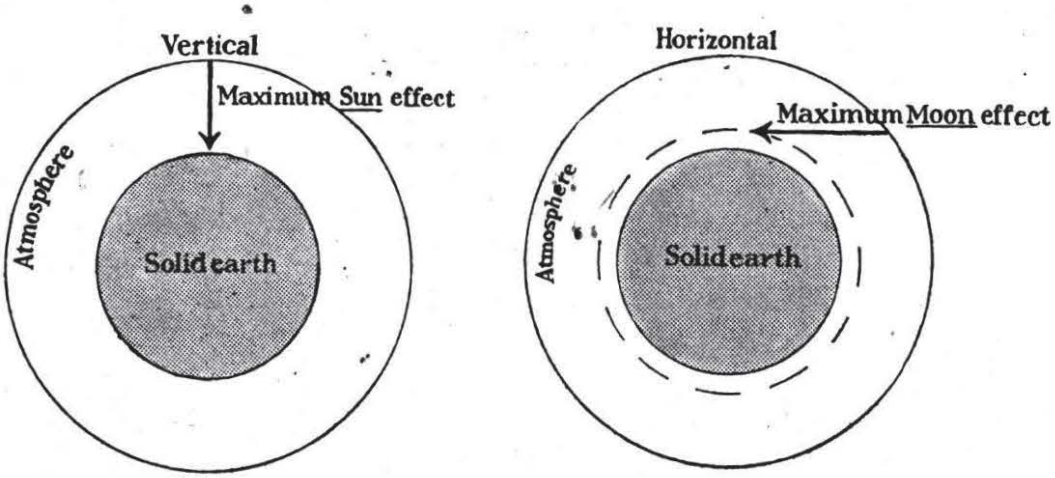
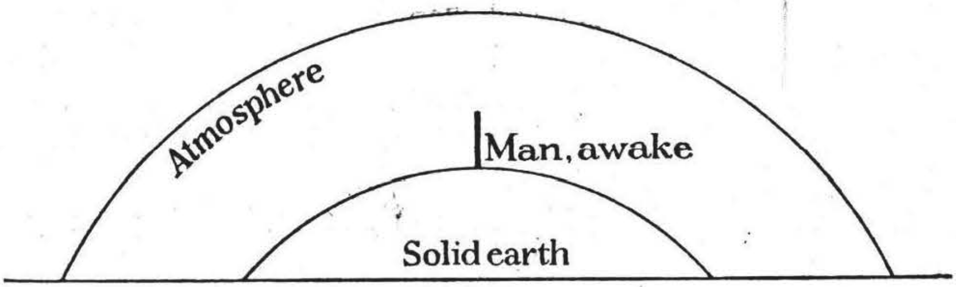
* Stefan Meyer und Egon R. von Schweidler, Radioaktivität, Leipzig, 1916.



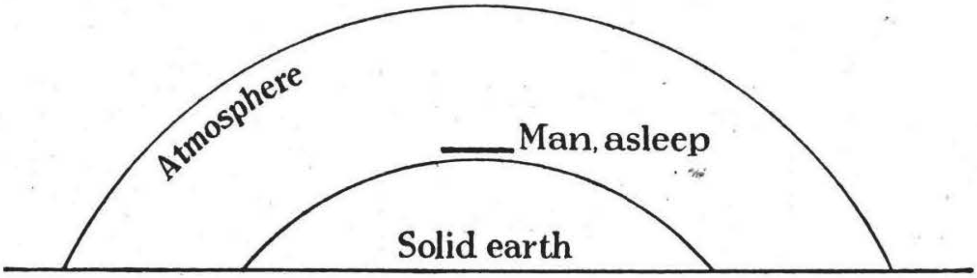
With reference to the latter fact, I might introduce here, among other things, experimental evidence cited by Professor Nippoldt in " Erdmagnetismus, Erdstrom und Polarlicht " : namely, the fact that the influence of the moon upon variations in terrestrial magnetism is exceedingly strong, indeed at its " maximum, when the moon is on the horizon, at its minimum during the upper or nether culmination of the moon " (p. 91). If meteorology and astro-physics will value rightly this individual observation in its full significance and vigorously develop it, this peculiarity of the moon influence will be generally confirmed.

Ancient schools of wisdom of the Orient and the Occident have always known this fundamental primal phenomenon, which we now begin to learn again, and these schools have always seen therein a decisive active principle for the evolution of the earth in that sense in which we shall seek below to explain these things according to our modern manner of expression.

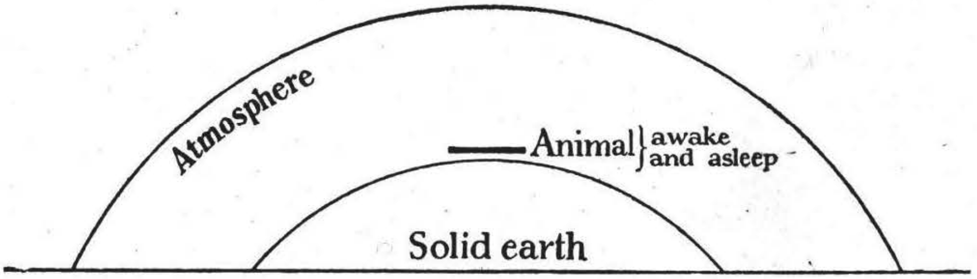
If one observes for example—thereby fulfilling the postulate set up for the future by the investigators of radio-activity, Professor S. Meyer and E. von Schweidler—the positions of the vertebral column of a sleeping man and an animal when asleep and when awake, as well as the direction of growth of a plant, one sees the following picture :


Atmosphere
Man, awake
Solid earth

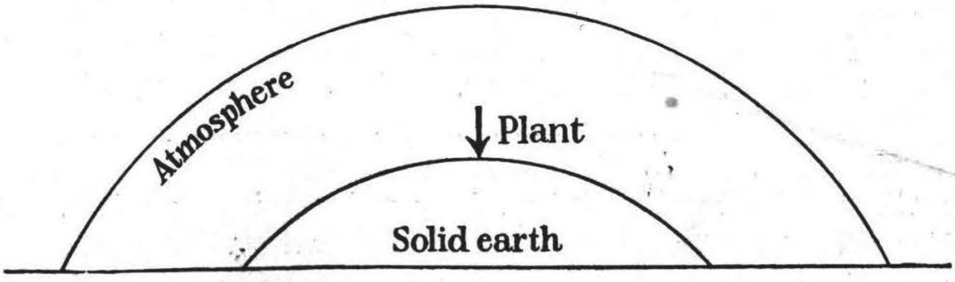
The vertebral column of man awake is vertical, perpendicular to the earth's surface.


Atmosphere
Man, asleep
Solid earth

The vertebral column of man asleep is, on the contrary, horizontal in relation to the surface of the earth.

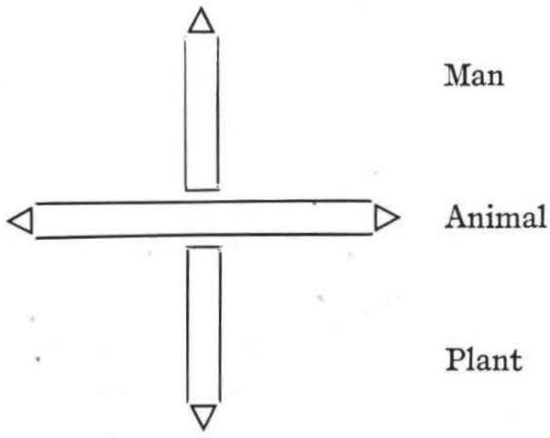

Atmosphere
Animal } awake and asleep
Solid earth

The vertebral column of the animal, asleep and also awake, is always horizontal in relation to the surface of the earth (with the exception of individual transitional forms).


Atmosphere
Plant
Solid earth

The direction of growth of the plant is, on the other hand, again vertical, perpendicular to the surface of the earth, but with an essential difference between the plant and man, awake. Namely, man has his head and nerve-system directed upwards, the metabolic and reproductive system directed downwards (Chap. XII). Plants, on the contrary, have their reproductive system, the blossom, directed upwards, and the opposite pole directed downwards.

Thus the three living kingdoms of Nature, in this polarity to the earth, are arranged as follows:



Plato, the great initiate in the Greek mysteries, spoke in regard to this truth those words concerning the three living kingdoms of Nature: "The soul of the world is slain on the cross of the world's body." Every one who is neither consciously nor unconsciously an adherent of the mechanistic-materialistic philosophy will hereby understand the profound and true meaning of these words.

If we now apply this truth concerning the direction of the vertebral column in the three kingdoms of Nature to what we have learned, this fact known to the ancients—that the sun's rays have their maximum effect when vertical and the rays of the moon when horizontal—we perceive that these three kingdoms of Nature are influenced as follows in their most important vital organs and processes by these two different currents which work upon the earth from the sun and the moon.

Man, when awake and erect, is coursed through, in his full length, in his brain and vertebral column—that is, in those organs of sense and of thought which, indeed, make him a man—by the sun current flowing vertically. (The daily life-current of etheric forces in the human organism we shall discuss in detail in Chapter XII.) On the other hand, man, when asleep, has placed himself in such a position that the vertical current from the sun works only at its minimum upon brain and vertebral column; whereas, on the contrary, he is coursed through in his full length when reclining asleep at night by the horizontally acting current from the moon.

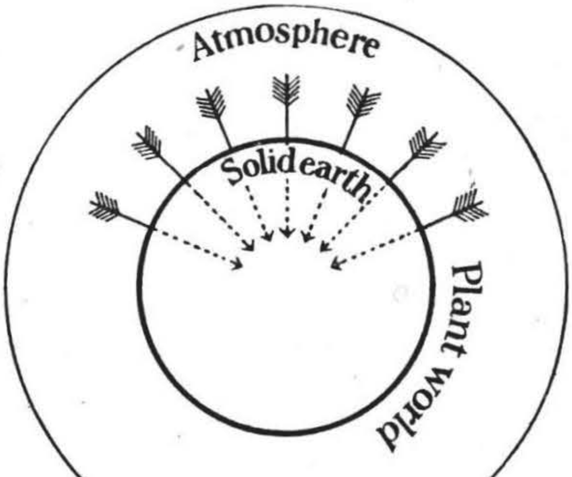
The waking man, therefore, fully self-conscious, receives, *through taking an erect posture, the utmost possible influence of the sun (the vertical); the sleeping man, on the contrary, not self-conscious, receives, through taking a reclining posture, the utmost possible influence of the moon (horizontal).* He who refuses to see anything more than "electrons" that course through the organism in these currents coming from the sun and the moon, which influence the life-processes and especially the phenomena of self-consciousness, will certainly be as far removed from reality as one who would explain the human world of concepts solely on the basis of " vibrations of the surface of the brain." As regards these things one may be permitted to say, in all modesty, that

> " There are more things in heaven and earth . . .
> Than are dreamt of in your philosophy."

It has remained for our age, at the turning point of the twentieth century, to desire to extend the philistinism of its earthly, mechanistic system of concepts to the cosmos and all which therein lives and weaves.

If, now, we observe the position of the vertebral column of the animal, we see that this, in contrast to that of man, is exposed at the maximum, even when the animal is awake, to the horizontal currents coursing out from the moon to the earth, and at a minimum to the vertical action of the sun. But this is characteristic and decisive for the life-processes and state of consciousness of the animal.

The plant, by contrast, is subjected to a vertical current whose tendency is centred toward the middle of the earth:



To what extent the plant is influenced by the vertical current coursing down toward the earth, and, reciprocally, influences this current, appears from the following fact cited in the lucid work of Dr. K. Kähler, of the Potsdam Meteorological Observatory, " Luftelektrizität " * —a fact which came to light as the result of measurements of the vertical current. He says (p. 85) : " Nowhere is there any current at all under the trees." And in another passage (p. 88) : " The first attempts to measure the current, for instance, which enters a tree occurred decades ago. This current may become rather strong in places where the lines of force crowd together." We see that the living plant kingdom of the earth stands in a very active reciprocal relation with the vertical current.

We have, therefore, to deal principally with the two extremely important terrestrial currents : a vertical current generated by the sun, and a horizontal current generated by the moon.

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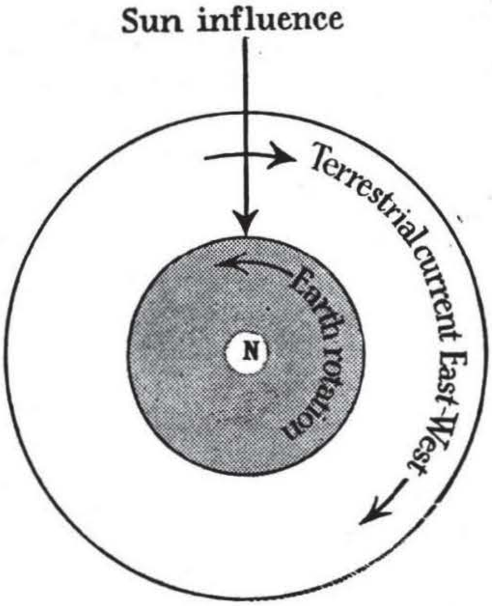
* Berlin, 1921.

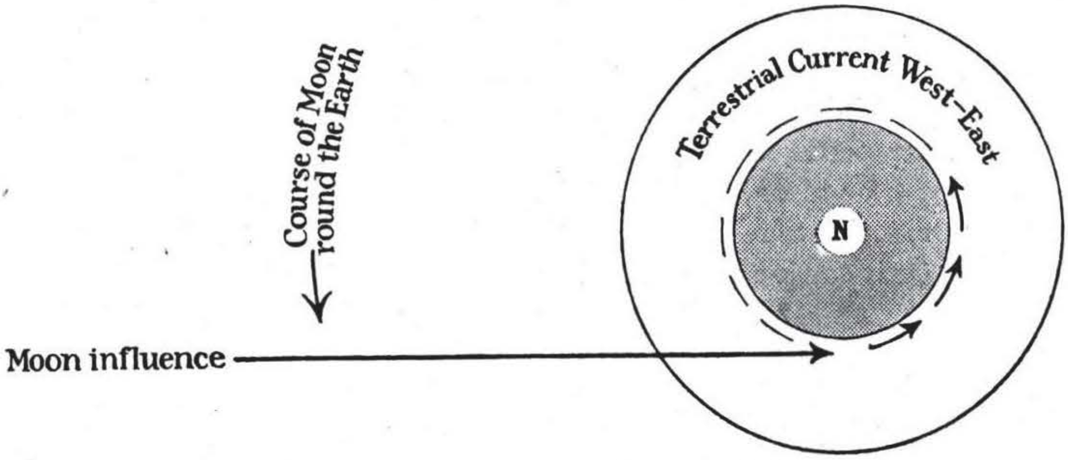
If we bear in mind that the vertical current is made up, as it were, of two chief components, the flowing of the warmth ether downward toward the solid earth and the exhaling of chemical ether into the atmosphere, then it appears that the part of the earth organism whose etheric forces are in this way reduced to chaos, and thus give rise to the phenomena of life and of the waking state, is naturally always turned toward the sun ; whereas the earth, because of the heliotropism described above, is always in rotation. Therefore, the chaotic dissolving sun influence, if observed from the standpoint of the solid earth outward, travels, as it were, over the rotating earth in a direction opposed to the west-east direction of the rotation. It is the effect of this important occurrence that we, as observers going along with the earth in its rotation, very rightly conceive as the terrestrial current flowing from east to west.



The east-west current, therefore, is a result of the influence of the sun, and shows its maximum upon the *day side* of the earth, turned toward the sun. In "Erdmagnetismus, Erdstrom, und Polarlicht," Professor Nippoldt, in speaking of the divers variations, remarks (pp. 128-129) : " We are most backward of all in the investigation of the terrestrial current ; yet we do know, at least, that it is composed of combined magnetic and atmospheric influences. . . ." And in another passage : " . . . . the energy, however, of all these variations does not derive from the sun, but from the energy-store of the earth's rotation." This statement thus supports throughout the comprehensive explanation given above. (See also p. 68.)

The east-west current encircling the earth is, therefore, an earth current, which is produced through the fact that the action of the sun causes the changes in the etheric structure of the earth organism described above and that this influence travels in an east-west direction around the earth. And this east-west current operates thus chiefly on the day-side of the earth—that is, by day.

Besides this east-west terrestrial current, to be ascribed to the action of the sun, there is also another current induced by the moon, which, however—in accordance with the west-east direction of the course of the moon round the earth—flows likewise in a west-east direction. Although the motion of the moon is slower than the velocity of the earth's rotation, yet in revolving round the earth from west to east it develops a strong activity of its own, in this direction, and its horizontally acting forces thus flow through the earth's atmosphere in this direction. The sun, on the contrary, develops no special activity in this sense in relationship to the earth ; and therefore only the stationary state with respect to the earth need be considered in connection with the vertical action of its force. This naturally cuts in an east-west direction through the earth's atmosphere, which is moving in the opposite direction (diagram p. 74). The current induced by the moon is, for the reasons given above, at its maximum in a horizontal direction and on the night side of the earth.



In addition to these two terrestrial currents during the course of the day—the east-west and the west-east current—there are, however, two principal currents which have an annual periodicity—the current flowing from north to south and that from south to north. It is observed that the north-south current is at its maximum in autumn-winter and the south-north in spring-summer. These two currents in the course of the year are, in turn, to be traced back to the heliotropism of the earth organism ; they arise from the fact that, with the beginning of winter in the northern hemisphere, the etheric forces flow toward the sun—that is toward the southern hemisphere ; and, on the contrary, with the beginning of summer, the etheric forces again flow back from the southern half of the earth to the northern hemisphere.

Naturally, this is a process taking its course gradually, but it has its greatest intensity in spring and autumn. (See diagram p. 77.)

This fact is illustrated for us also in a beautiful manner through an occurrence which, until now, has never been given any true explanation : *the migration of flocks of birds over the earth,* towards the south in autumn with the etheric current then setting in, and in spring toward the north with the strong current then setting in. Men have till now wondered at the inexplicably sure " instinct " of the flocks of birds in flight, by means of which they fly each year over immense stretches of the earth in a north-south and south-north direction. But the word " instinct " is nothing more than a name standing for an unknown quantity. If men would give close attention in the sense here intended to this occurrence, they would find that the unique sense of direction of migrating birds does not arise from a sense of geographical direction—which the young especially, sometimes entering upon the journey for the first time alone, could certainly not possess at all—but corresponds to a fine, intimate reciprocal relationship between the etheric life-creating forces, their earth-currents, and the animal world, extremely sensitive to these things.* In man this sensibility and this *interplay with his etheric environment* has disappeared from consciousness as a result of the strong *ego-development,* his materialistic objective consciousness, one-sidedly developed, and other circumstances later to be discussed. That is, it is now lost, although in past times he still possessed it. Man will recover it again in the coming centuries—no longer unconsciously—a truth of which the signs already reveal themselves for one who has an open eye for everything and does not, because of scientific dogmatism, play blind-man's buff in the presence of such phenomena. The reciprocal influence of the other etheric currents, associated with the position of the vertebral column and with the states of consciousness, we have already observed.

A tremendous vista for the future ethnology, zoology, botany, etc., opens up to one with the investigation of the changing geographic distribution of the etheric formative forces within the earth organism, when one realizes that here is the doorway to a true understanding of the hitherto unexplained appearance and dying out of races and genera and species of the several kingdoms of Nature in the different geographical regions of the earth. For in the course of thousands of years also an alteration occurs in the basic etheric structure of the earth, a continual metamorphosis. (See Chap. X.) We shall return to this subject. Whoever, indeed, is willing to understand only mechanically the etheric world and its activities in relation with the living kingdoms of Nature, had better renounce from now on an understanding of the deeper nature of such things.

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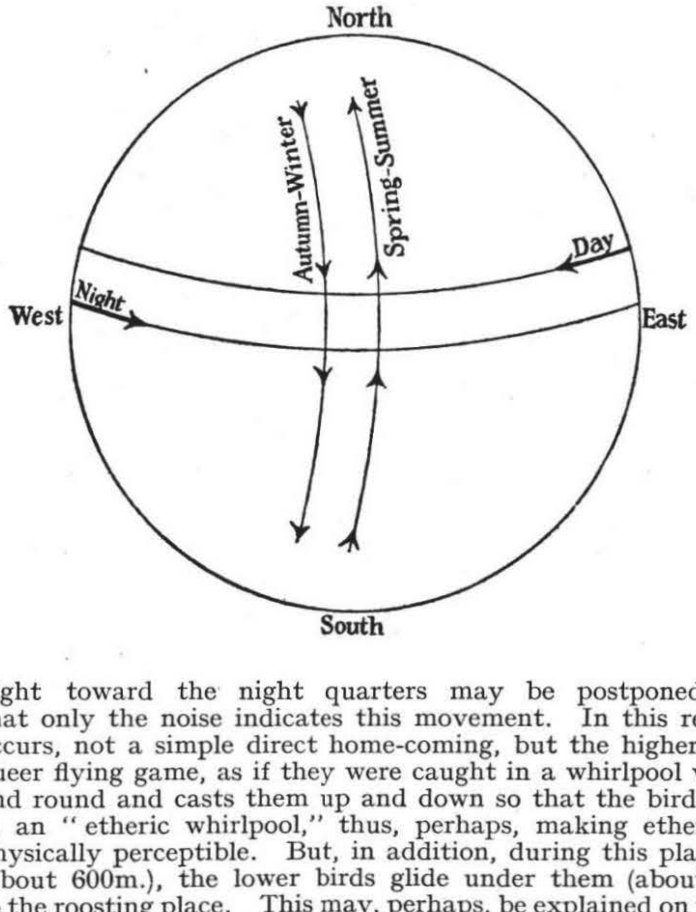
* Herr Hans Jenny, of Basel, has been kind enough to call my attention to the following interesting ornithological phenomenon, which seems to show that the laws governing the movements of migratory birds fit, not only into the south-north and north-south currents in the course of the year, but also into the east-west and west-east currents in the course of the day. The crows and jackdaws found widely scattered about Basel in summer, together with the rooks coming from the north and wintering here, collect in the environs of the city in droves, numbering, perhaps, 6,000, and spend the winter generally in flocks of several hundreds. At sunrise they pour forth in great caravans, soaring in the sunlight from their night-quarters in the east toward their feeding grounds in the west, a distance of ten miles. At sunset this process is reversed, except that in this case the west-east direction is not accurately maintained. While the time of the morning flight is strictly observed and the flight is carried out in spite of the strongest adverse winds and other hindrances, and thus accompanies the etheric currents of the sun flowing intensively in the morning in the east-west direction, there are the greatest differences in the time of the evening break-up. The birds never leave the feeding grounds before sunset but their

We have been able to take a view of the four great essential currents within the earth organism.



1. The east-west current, a result of the activity of the sun, exerts its strongest influence in the vertical direction; it stands in reciprocal relation with man, awake, standing erect in waking consciousness, and also to the vital activities of the rest of the kingdoms of Nature *during the day*.

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flight toward the night quarters may be postponed till so late at night that only the noise indicates this movement. In this return journey there often occurs, not a simple direct home-coming, but the higher-flying flocks carry out a queer flying game, as if they were caught in a whirlpool which drives them round and round and casts them up and down so that the birds appear to tumble about in an "etheric whirlpool," thus, perhaps, making etheric movements in a way physically perceptible. But, in addition, during this play of the birds flying high (about 600m.), the lower birds glide under them (about 150m.) quite peacefully to the roosting place. This may, perhaps, be explained on the ground that the higher flocks are still in the disappearing sun influence, while the lower birds in the "shadow" heed the west-east current prevailing at night and flow back with it in this direction.

See in this connection also: Hans Jenny: "Der Vogelzug und die ätherischen Ströme." (Gäa Sophia, Vol. I., Dornach, 1926.)

A systematic observation of the migration of birds in the course of the year and also of the day and of similar phenomena among other species of animals (such as bees, ants, etc.) would certainly lead us, through consideration of the etheric earth-currents, to a knowledge of important inter-relationships and laws.

2. The west-east current, a result of the moon's activity, exerts its strongest influence in the horizontal direction ; it stands in reciprocal relation with the dream-consciousness and deep-sleep consciousness of man, while he is in a reclining position ; the animal, on the contrary, on account of the horizontal position of its vertebral column, is exposed even while awake to the maximum influence of this current.

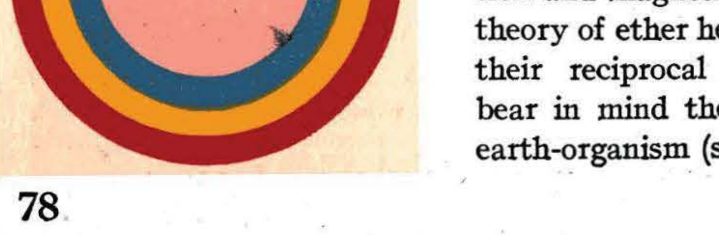
This current acts at its strongest during the time when the earth organism, not upset by the sun, strives to establish its basic structure—therefore, *at night.*

3 and 4. The north-south and south-north currents with their intimate alternating relationship with the soul-life and with the vital activities of the kingdoms of Nature, especially *in the course of a year.*

Obviously, we can merely mention the enormous complex of questions which appear in this combination of facts, and only by way of reference to an endless perspective. All these phenomena are subject to many variations and associated influences, and we can speak here only of the fundamental activities, the tendencies of their influence. But, without bringing these tendencies of the etheric into connection with our investigation of Nature, we shall not be able in future to understand either the animate or the inanimate.

The Nature of "Gravitation" and of Terrestrial Magnetism

Unique and hard to understand among the phenomena of Nature are terrestrial magnetism and, most especially, that which we call "gravitation." Professor L. Graetz in "Der Äether und die Relativitätstheorie" refers thus to gravitation (p. 66) : "Concerning the force longest thoroughly known in its general principles and yet one of those most completely outside our understanding . . . concerning gravitation, or the general force of mutual attraction among all bodies, of which gravitation is simply a special case . . ." Elsewhere he expresses the conjecture (p. 66) "that gravitation also is in some way a process in the ether." In order to understand both gravitation and magnetism on the basis of the theory of ether here set forth, and also in their reciprocal relationship, we must bear in mind the etheric forces in the earth-organism (see diagram).



" Gravitation "—that is, that which causes substance, bodies, to tend toward the centre of the earth, is nothing other than the effect of the suctional activity of life ether centralized in the solid earth. We noted in Chapter II in discussing the states of aggregation, that the life ether induces the solid state of substance ; it is, therefore, clear now that the life ether of the earth exerts its greatest activity upon those bodies which stand closest to this state subject to itself, those which have brought about that state in the strongest and most concentrated degree. Those bodies in which the tendency to become identified with the related life-ether centre of the earth is at its strongest we call " heavy bodies." In contrast, bodies whose structure (fluid, gaseous, etc.)—to be ascribed more to the chemical, light, or warmth ether—is less adjusted to the life ether, have correspondingly less tendency, or none at all, to strive toward the life-ether centre of the earth. These are " light bodies."

The behaviour of all individual bodies within the earth organism is due, therefore, to the tendency of the earth organism (described in the beginning of this chapter) constantly to re-establish the normal distribution of its formative forces and of the various substances linked up with these. What we have been able to observe in the matter of the " reversal of temperature," as regards the returning of the etheric forces into their natural spheres, reveals itself now also for the world of substance in its varying relation to " gravitation." The earth does not rest until it has brought the solid, fluid, gaseous substances within its organism to the spheres of the corresponding formative forces. In the gaseous bodies, therefore, the light ether which conditions these, strives always toward the light-ether sphere of the earth organism—that is, upward ; in solid bodies, on the contrary, the life ether, which—in this relation called gravitation—conditions these, strives toward its own sphere in the earth organism, toward the interior of the earth—that is, downward (see preceding diagram). Why, now, the earth as a whole tends toward the sun we shall come to understand in connection with the discussion of the sun.

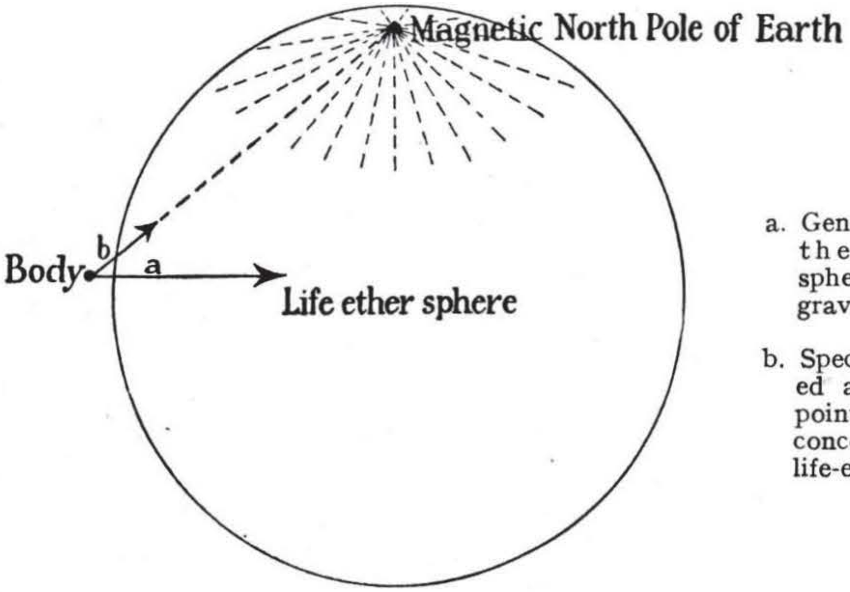
In the book already cited, " Erdmagnetismus, Erdstrom, und Polarlicht," Professor Nippoldt says : " Terrestrial magnetism occupies a middle position between gravity and the phenomena of meteorology. With the first it is connected through the similarity existing between magnetic attraction on the one hand and the mutual attraction of bodies in space and the omnipresent manifestation of this latter, and through the fact that magnetism also is a force acting in a certain direction. For, just as gravity on the earth always acts downward, so also the magnetic pull of the earth—or terrestrial magnetism—always expresses itself in a determinate direction.

" Yet it is distinguished from gravity in particular in this—that it only turns a magnet away from the general relationships of which we know, but cannot move the magnet in space. A magnet falls only because it is subject to gravitation—not as a magnet—and does not increase in weight. Generally speaking, the force of terrestrial magnetism is distinct from gravitation by reason of its continual variability, whereas, although gravity also is certainly subject to such modifications, these are so slight that only very recently has it been possible to prove them conclusively. The great importance of the part played by the magnetic forces in the cosmos, related to terrestrial magnetism, is now beginning to be understood."

The fact only recently discovered that gravitation is not constant, as physicists had previously believed, but is variable, corresponding thus to the etheric structure of a living organism, has fortunately brought some variability in conceptions which had before been fixed and mechanical.

We need, then, only to inquire what is the mutual relationship between " gravitation " and " terrestrial magnetism." Each, as Professor Nippoldt says so clearly, is a directional force. The direction of gravitation is toward the interior of the earth—or, more accurately, toward the centre of the earth ; the direction of a magnetized body (the magnetized needle, for example) is also toward the interior of the earth, but toward a locality in the region of the earth's pole. If we apply here the explanation already given, that the phenomena of gravitation are due to the suctional action of life ether, then it will follow that terrestrial magnetism, directed toward the pole, is only a special instance of the universal magnetism of the earth, the cause of which is identical with that of the phenomena of so called " gravitation "—that is, the suctional action of life ether acting from the interior of the earth. The magnetism operating from the magnetic pole is only a plus in the suctional pull operating from points where the life ether within the earth is less disturbed—that is, points of greater concentration. The magnetic poles are not fixed spots in the body of the earth, but points of the least disturbance and hence of greater concentration and activity in the force-sphere which belongs to the force of life ether ; as such, these are shifting points : that is, they are centres of force in the etheric earth.

In our observation of the occurrences within the etheric earth, we have seen that the etheric earth—because of rhythmical influences proceeding from the sun and the moon—is subject to a constant alternation, expressed in the alternate chaotic upsetting and restoration of the basic structure of the earth. Now, this alternating, disturbing process is naturally at its maximum in the region of the equator and its minimum in the region of the poles. Accordingly, there must be points within the earth organism where the constant concentration of life ether and its unmodified action reach their maximum. Such points, then, of the heightened activity of the life-ether are the magnetic poles.



a. General activity of the life-ether sphere: — so called gravitation.

b. Specially heightened action from points of increased concentration of the life-ether sphere.

(What findings result from this fact regarding the structure of the earth we shall indicate in detail in Volume II.)

It has been shown conclusively by recent research that terrestrial magnetism is not—as had been mistakenly supposed—fixed to the shell of the earth or a characteristic of this, but that it is a result of the action of a truly variable field of force. Professor Nippoldt says in regard to one of the usual variations of this natural force (p. 57): "The secular variation comes about through the fact that the closed field as such moves round the earth—that is, the anomalies in terrestrial magnetism move along over the earth. This would signify that they are not characteristics of definite parts of the shell of the earth, so that in this matter we face the greatest, if not quite insurmountable, difficulties in our physical explanation of terrestrial magnetism."

Since, moreover, it has been shown experimentally that the magnetism of the earth is by no means uniform and we come upon regions of great disturbance in the most widely separated parts of the earth (Kursk in Russia, the Gulf of Finland, etc.), it is clear that terrestrial magnetism is not to be looked upon as a force entirely different from "gravitation," but as a special example of the same force: that is, as an action of the life ether intensified at certain points of the etheric earth, but identical with that which otherwise reveals itself uniformly in the phenomena of "gravitation." We might, therefore, say that the magnetic poles are points of intensified action of " gravitation " ; but, since this *plus*, as compared with the universal " gravitation " acting toward the centre of the earth, is so slight as to be almost imperceptible, it suffices only to suck the pivoted magnetic needle in this direction, but not to affect the magnetic needle when it falls, under the influence of the force-component directed toward the centre of the earth. The life-ether centre of the terrestrial pole acts upon the same force in the magnetic needle. (See below.)

An evidence of the fact that life ether is the uniform common cause of " gravitation " and terrestrial magnetism is contained in the following fact, mentioned by Professor Nippoldt (p. 42) : " Since heavy rocks are generally capable of being more strongly magnetized, it must seem probable that magnetic disturbances are connected with those of gravity. This has also, in fact, generally been confirmed wherever investigation has yet been made—for instance, in the Hartz Mountains, at Bornholm, South Africa, and elsewhere ; the lines showing no deviation of the plummet are parallel with those free from magnetic irregularities."

But we can go much further and say in the sense we here mean : *Magnetism and gravitation, both on the earth and in the cosmos, are forms of expression of the same cause—namely, of the life ether. The intensity of the inner tendency of bodies to strive toward a life-ether centre differs according to their own inner kinship to this ether.* The " love and hate of the elements," in place of which the well-known physicist Nernst, as quoted above, says that we have at present only substituted the equally unintelligible conception of the " affinity of atoms," are only the eternal alternation of this striving toward the *union of a body with its etheric home* or toward its separation from a foreign etheric sphere, with all those endless variations and possibilities which are afforded to these processes of union and separation within the earth organism and the cosmos, as their field of play.

There is associated with the points of greater concentration of the suctional forces—as we have learned to call the magnetic poles—one of the most wonderful and characteristic phenomena of the earth organism, the deeper significance of which has not yet been revealed : that is, the polar light, or northern lights (*aurora borealis*). The reciprocal relation between the northern lights and terrestrial magnetism has been thoroughly established by recent research. I wish to cite here only one experimentally established fact which finds its explanation in the view of ether we have set forth. Professor Nippoldt says : " From measurements made in those regions and now abundantly available, it seems that atmospheric humidity is not entirely without its influence in the production of the polar light : but no relation with other elements has been indicated. Still more intimate is the relation between the *northern lights and cloud formation. . . .*" We recall that the suctional *chemical ether is also the creator of the liquid state of aggregation in substance* (Chaps. II and IV). The magnetic poles thus show themselves as points of intensified action on the part of the suctional group of etheric forces, chemical ether and life ether, not only as indicated above, but also in this association of the polar lights with humidity and cloud-formation. (For details, see the discussion of the ontogenetic origin of substance, Chap. IV.)

After considering the etheric forces of the sun we shall also understand that alterations in the etheric structure of the sun, as these manifest themselves, for instance, during periods of sun spots, are naturally associated with influences upon the great centres of chemical ether and life ether in the earth—that is, with the phenomena of the polar lights.

The Sun

On the way toward an understanding of the true nature of the unique *phenomena of magnetism* in its most varied fields of action, mankind never passed during the last century—for this we may well be grateful—even through the first gateway to knowledge. It was well that this should not happen in an age characterized by a mechanistic and materialistic conception of the world ; for the harm which might arise from this sort of philosophy and from practices conditioned thereby in these fields is almost unimaginable.

A decisive change of view came about through the discovery by Hale of solar magnetism, which reduced terrestrial magnetism to the status of a part of cosmic magnetism. Whereas at an earlier period any one who maintained that a body glowing-hot could be magnetic would have been charged with complete ignorance by physicists of the older school, it has been conclusively proven in recent years that the sun, which has been looked upon as a glowing-hot gaseous body is, none the less, magnetic to a tremendous degree. Its magnetic intensity is reckoned as fifty million times that of the earth (Nippoldt, p. 49). It is to be feared that any one who now maintains that the sun is not a glowing-hot gaseous body will be charged with complete ignorance just so long as this fact has not been conclusively established. In spite of this risk, such a view must here be placed at the very basis of the phenomena under discussion if we are to understand them.

For many years now Dr. Rudolf Steiner has declared and emphasized again and again the fact that the modern physicist would be utterly astonished if he should discover some day that the sun is not a gaseous glowing ball of molecules whirling about among themselves, but a cavity not filled with substance—or, better expressed, a " minus space " a " vacuity in space " as contrasted with the rest of world space with its substantial and insubstantial contents. Since in this book the world-conception must be considered only from its etheric aspect, we cannot discuss the mysteries otherwise connected with the sun. Considered from the etheric point of view, the sun is a space not filled with substance, but in which the etheric forces of life ether are active. We have already explained the influence of this ether as linked up with states of consciousness and life processes, as these come to expression in the terrestrial realm. We shall later be able to complete this conception as regards the view of the life-current flowing through man (Chap. XII).

If one looks upon the sun as in reality " not filled with substance " in the above sense, but as the field of activity of pure life ether in its various modifications, then we need not believe the contradiction that it is a glowing ball of gas and at the same time tremendously " magnetic," and yet this contradiction is generally believed to-day, for the reason that men will not give up the theory grown familiar to them in which the sun is a glowing gas ball, in spite of the fact that this contradicts all that we have learned within the earth organism. We meet with the same difficulty in explaining the core of the earth. To this we shall later return. For gases are, as we know, almost wholly dia-magnetic, non-magnetic ; in the sense we intend, they do not belong in the sphere of action of life ether—with the exception that, according to experience, oxygen is less unmagnetic than other gases. This last we shall be able to explain in a later discussion of light (Chap. VII).

But, if we attribute the phenomena of magnetism to the action of life ether, as we have done above, and if we look upon the sun as a body which is wholly filled with elements of this life ether, we then understand the tremendously powerful magnetism of the sun on the basis of the nature and content of the sun itself.

The Planets and their Spheres

If we recall, now, that terrestrial magnetism, and especially the fields of its intensified action, the magnetic poles, are to be attributed to the activity of terrestrial life ether, we shall arrive at an explanation of a third movement carried out by the earth organism, in addition to its revolution round the sun and its rotation. A consideration of this motion—even though it is of the maximum slowness—is of the utmost importance for an understanding of certain facts in our planetary system.

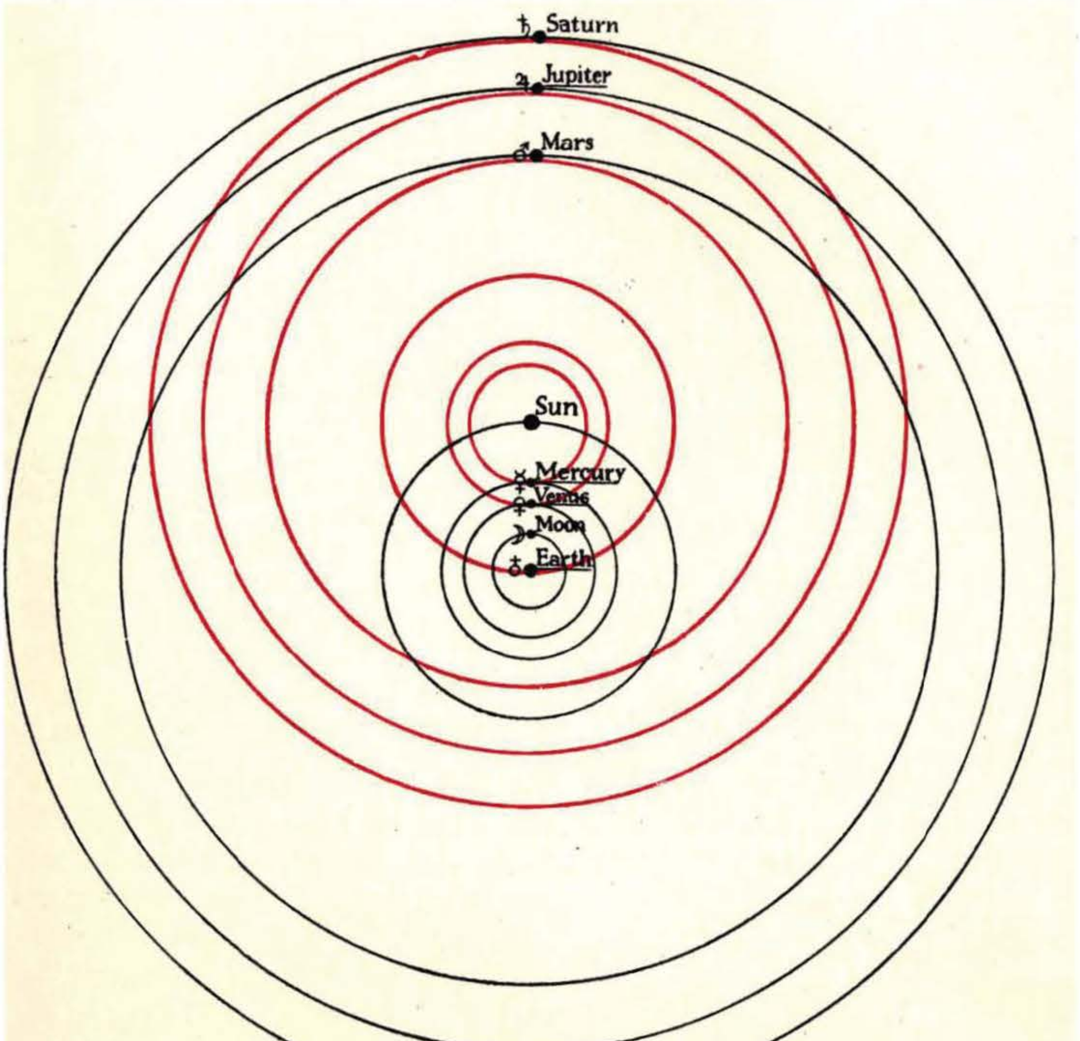
Just as " heavy " bodies, more perfectly adapted to the state of life ether, show a greater striving toward the centre of the earth than " light " bodies, so also there is a special form of attraction between the life-ether centre of the sun and that magnetic north pole of the earth, which we have come to know as a point of intensified action of the life ether. This mutual attraction leads to a scarcely perceptible motion, which goes through its course in a tremendously long period of time, and which brings the magnetic north pole of the earth, and thus the earth itself, in the direction of the sun. When once carried through, after an enormous lapse of time, this motion will bring it about that the north pole of the earth will point directly toward the sun. The alternation of an ice age and a tropical climate at certain points on our planet is connected with similar movements at earlier periods.

We shall not be able to discuss the further consequences of this motion, but the phenomenon is only mentioned for the reason that it is necessary to an understanding of the following important matter. That is, it is an undisputed fact that the moons of all the planets move, according to the laws of Kepler, from west to east around their primary planets, with the *exceptions of the moons of Uranus and Neptune,* which revolve in the opposite direction around their planets. *These planets fall, therefore, outside the general laws of our system.* This fact is to be explained only on the ground that Uranus and Neptune have gone through the motion mentioned above, not only to the extent of 90 degrees, but to about 180 degrees—that is, their north poles point downward, or, from our point of view they stand on their heads. For these planets the sun rises—as we feel—in the west and sets in the east. We call attention to this fact only to indicate that Uranus and Neptune do not belong, according to their general laws, in our system, in the same sense as do the other planets.

If one speaks to-day to a half-educated man—and oftentimes even to a cultivated man—of the influence of the planets upon terrestrial occurrences, one is generally met by an uncomprehending smile, if by nothing worse. In absolute contrast with this fallacious scepticism, exact scientific research in this field shows such an influence in the most specific details. Professor Nippoldt, for example, says in regard to variations in terrestrial magnetism (p. 93) : " The influence of the planets also has been brought into the reckoning. . . . It also is certainly present. Both the general average and also the daily range of variations is influenced by this, the latter even much more strongly." He then cites a fact very impressive in reference to the question of planetary influence upon terrestrial occurrences : " The exceptional position of Mercury in both series is very striking."

Moreover, the extremely important fact has also been experimentally established that the " action of the Sun is at its maximum when the planets Venus, Earth, and Jupiter are as nearly as possible in a straight line" (Sellmayer, Nippoldt, p. 93). I wish, therefore, to take as the foundation for the following consideration of the activity of the planets a corresponding arrangement. This arrangement was described and discussed by Dr. Rudolf Steiner many years ago as being of the utmost reality in its significance.

The several individual planetary orbits are here schematically diagrammed in circular form.



In this diagram, then, the planets which revolve round the sun (red circles) are placed in that arrangement which scientific research has proven to be favourable to the greatest activity of the sun (Venus, Earth, Jupiter in a line, which occurs about every 11·8 years—that is, relatively often. The other planets are arbitrarily located in their orbits, but here, for the sake of convenience in observing, in a straight line.) Uranus and

Neptune are left out, on the ground, already mentioned, that they differ in essential respects from the other planets.

In considering the action of the planets upon terrestrial occurrences, it will be necessary in future to take a much broader view if we are desirous of reaching a comprehensive grasp of the group of facts under consideration. The wise men of past centuries, especially those of the Chaldeans and the Egyptians, possessed a knowledge of these things which, unfortunately, is entirely lost in essential points to our own age, so extraordinarily proud of its scientific achievements. It is fortunate that it has occurred to some of the most advanced investigators to bring the action of the planets under consideration in exact fashion in relationship with the earth, although we are only at the beginning of this inquiry. We shall later see that the *influence of individual planets upon terrestrial magnetism*, for example, is very clear and very varied. Professor Nippoldt gives the following table determined by Leyst showing the influence, for example, in the modification of the mean daily declination at the time of the upper and the nether culmination :

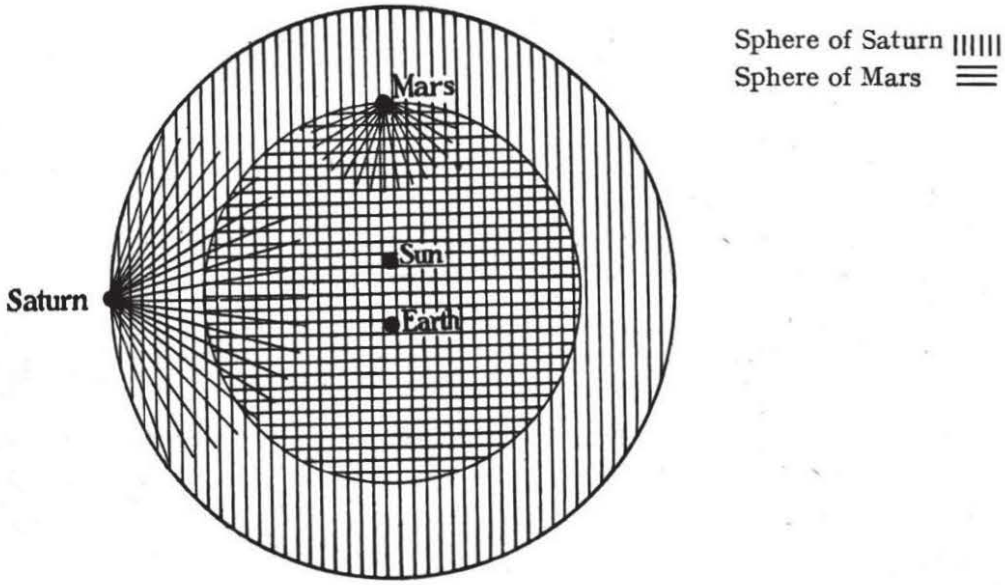
By Mercury	+0′·37±0′·09
By Venus	– 0·40±0·17
By Mars	– 0·43±0·24
By Jupiter	– 0·29±0·17

"The maximum range of the daily variation is modified according to the following series of percentages (+ means increased, – means diminished) : Mercury+11%, Venus–10%, Mars–4%, Jupiter–19%, Saturn–2%."

The decisive point in this is the fact precisely proven that there is a real *influence from the planets in terrestrial relationships*. But a mistake is generally made in the manner in which this influence is viewed. Obviously the influence of the planets upon terrestrial magnetism should lead us to consider this influence after the manner of magnetic fields and spheres. If, upon observing the action of the magnetic north pole upon a magnetic needle at some arbitrary place on the earth, I should say that the magnetic phenomena in question occurred only at the magnetic pole and at the spot of the needle, but not at the same time at all other points of the globe, any logically thinking person would consider this to be nonsense. Yet in considering the influence of the planets upon the earth at some arbitrary point in its orbit, the mistake is generally made of considering only the planet and the earth, and likewise only an activity flowing in a straight line from the planet to the earth, instead of considering the occurrence—as in the case of terrestrial magnetism—after the fashion of magnetic spheres of great extent.

Just as the magnetic pole of the earth is only a point of greater concentration of the magnetism universally operative in the globe, so also is each planet only a point of greater concentration in the action of its forces in the sphere subject to it. The action which we can prove experimentally on the earth as the action of Saturn, Jupiter, Mercury, etc., does not proceed at any point of time only from the body of Saturn, Jupiter, Mercury, etc., but from the entire sphere belonging to the planets in question. The planet in reality, then, exerts in its momentary position only a considerable concentration of the universal action of its sphere.

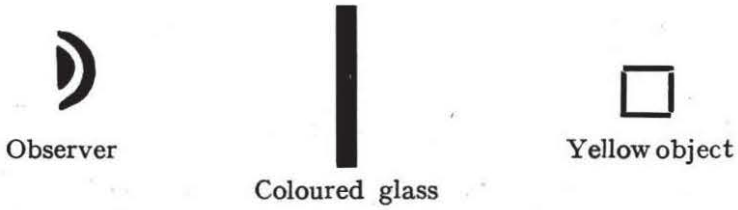
Schematically drawn :



The same thing holds good, naturally, for the other planets represented in the diagram on page 86. (In regard to their influence over the earth, this is schematically shown by black lines.)

Let us consider more thoroughly what we really have before us in this matter. *We can in this manner divide the cosmos into great fields of space (spheres) which are filled with the etheric active forces of the individual planets.* Since these spheres of space partially intersect each other, there are, therefore, some spheres in which only the etheric action of single planets is operative, and other spheres in which the etheric action of two, three, four, or more meet and mutually cross and interpenetrate one another. In order to illustrate what follows from this for astrophysics and other fields of cosmic theory, we may introduce the following comparison.

Let us suppose, for example, a body of a yellow colour set up at a certain point, and an observer standing at another point, at a specified distance away, so that he clearly perceives the yellow body as it is. But there are now thrust between him and the yellow object pieces of glass of the most varied tints. No reasonable man will now maintain that he will see the object as it is in reality. If, for instance, there is a blue glass (or a blue mist, etc.) between him and the object, then, if he does not know this fact, he will maintain with the most dogmatic certainty that the object itself is of a blue-greenish tint, whereas it is really yellow. We must not here fall into the error of the false subjective conception of the nature of colour, for the object is and remains yellow, and will appear truly as yellow to any one who sees the yellow object, not through the blue glass, but apart from this medium. I must always endeavour to discover with exactness whether between me and an object under observation some one or more spheres of activity (blue glass, etc.) have been thrust, which cause the reality and the appearance of the object in question to seem to me different from what these really are.



But are we not in the same situation in observing the planets through our optical instruments, though these suffice to make those holding a mechanistic-quantitative conception of the world willing to pronounce decisive things about the cosmic system ? Every physicist will admit that it is the cosmic ether which transmits to us the phenomena perceptible through optical glasses, telescopes, etc. But the cosmic ether, when I look, for example, from the earth toward Saturn, is by no means a constant and uniform quantity. This world ether is subject not only as regards space, but also as regards time, to a never ceasing organic change, though this takes place very gradually over very long stretches of time. It is differently composed when I view the Moon and when I view the Sun ; and differently again when I view Mercury and when I view Saturn.

Professor J. Plassmann cites in his " Himmelskunde "* the following thoroughly established fact (p. 160) : " There are fixed stars which regularly, within brief periods, suffer a diminution of their light. One supposes that this loss of light is caused by revolving bodies which cut us off partly for brief periods from the light of the fixed stars." As a matter of fact we observe Saturn or any other planet, as well as the fixed stars also, always through " coloured glass "—to use our comparison—partially in continual alternation, and partially more or less unchanging—that is, *through the etheric spheres of the individual planets.*

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*Berlin, 1924.

But our modern knowledge of these heavenly bodies rests most of all upon the spectrum analysis—that is, upon the analysis of the rays of light which, through the medium of the ether, pass through the instrument in question when we direct it toward specific planets. But there is here the additional fact, which I will merely mention, that we always look through a medium consisting of an atmospheric stratum subject to purely terrestrial laws, which, however, has never been clearly investigated as to its constitution and the structure of its forces. In the work of Professor W. Nernst already cited, " Das Weltgebäude im Lichte der neueren Forschung," there occurs a very satisfactory sentence which rejects in splendid fashion the practice now unfortunately so general of applying terrestrial laws systematically to the cosmos. He says (p. 37) : " Cosmic physics is not ordinary physics. What must here be disapproved as uncorroborated speculation may there become a necessity of thought forcing itself irresistibly upon our investigation." Since we shall see in the discussion of the theory of colours (Chapter VIII) that the origin of the various shades of colours lies in the joint action of etheric forces in various ways according to general laws, it will be clear to us that the sort of research hitherto practised in reference to the cosmic bodies can never bring us to true and permanent conclusions as to the nature and the phenomena of these cosmic bodies and centres of force—acting upon our terrestrial relationships—until the nature and action of the etheric shall have been made clear through a knowledge based upon reality. Then, however, the merely mechanistic and quantitative conceptions of the cosmic system will speedily take their place with other things belonging to a quickly vanishing past. For this new method of research, however, the basis will be an organic conception of the various cosmic spheres of etheric action belonging to the several planets and heavenly bodies ; and we shall, by including the other attributes of the etheric, reach a more profound understanding of the " world organism " and its life processes linked with physical motion, etheric currents, and states of consciousness of the most varied kinds—a more profound understanding, that is, than will ever be possible for the mechanistic-quantitative observation of the world.

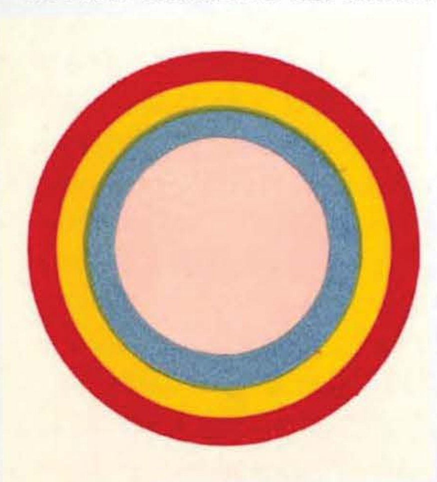
It may be well to call to mind here the passage previously quoted from the book " Radioaktivität " by those two distinguished scientists, Professors St. Meyer and E. von Schweidler (p. 20) : " We may, perhaps, consider that the human organism continually takes ' electrons ' out of its environment and gives these back, under the action of light and heat ; perhaps a not distant future will permit us to speak of a ' cycle of electrons,' out of the environment into man and back into the environment, of whose action upon our life-processes we have at present no knowledge whatever."

Whoever has admitted into his thought, without prejudice, and in complete perspective, that which is linked up with the nature of the etheric will perceive that it is by no means only " electrons " which stream in eternal alternation into the human organism and the living beings of the other kingdoms of Nature and out again, but that these are entities which in their totality can never be grasped within the range alone of the theories of modern physics, electricity, and the like. But the two investigators of radio-activity are right primarily in this : that we are here dealing with occurrences " of whose action upon our life-processes we have at present no knowledge whatever." We shall later arrive at conceptions in anatomy, zoology, and botany—and also in organic and inorganic chemistry, in meteorology, geology, etc.—which will have little in common with the mechanistic world-concept prevalent at the turning point between the nineteenth and the twentieth century. The setting up of abstract conceptions—such as the potential gradient, vertical current, emanation, induction, magnetism, etc.—will not suffice for an understanding of even the most superficial of those great life-processes which are bound up with the action of these forces, but which have in our day been rendered dead, and therefore unintelligible, by reason of our physical abstractions. Here we shall refer—even at the apparently certain risk of being metaphorically stoned by a certain sort of specialistic school-mastership—to a truth which comes as an entirely logical inference to anyone who thinks accurately. If we conceive the postulate quite justly expressed by Professors St. Meyer and E. von Schweidler concerning research into the action of forces entering into the human organism—if we conceive this in conjunction with the scientific findings reached in regard to influences of the sun, moon, planets, etc., upon terrestrial force-relationships and life-processes, we shall then come—provided we think logically and without cowardice—to the irrefutable conclusion that *the array of forces acting upon a point on the earth, an array of forces influenced as has been proved by the sun, moon, and planets, plays a weighty rôle in the coming into existence of a human being,* as well as in the development of other organisms.

It is one of the most serious of false inferences we can commit in research when we admit the influence of the planetary spheres of force only in relation to the " *dead substance* " of the magnetic needle. It is not only logically to be inferred but also a fact amply established that the *" living substance " of organisms reacts strongly and in much more delicate* *fashion to the field of force forming their environment.* But this field of force—as, for instance, we have clearly seen in the matter of variations of the magnetic needle—is influenced, in its mutations, continuously and in measurable degrees by the macrocosmic motions of the planets. This field of force is one thing when a planet is at its culmination, another when two planets are in opposition or in conjunction, etc. Our entire life-process goes on in an environment in which the structure of forces is continually changing. The air-space, for instance, in which we breathe, is subject, in respect to its delicate structure of forces, to a continual mutation, regular and organic, for it takes its structure from macrocosmic processes, the tremendous etheric spheres of force of the planets, through which our earth moves and which interpenetrate our atmosphere and continually modify it. In Chapter XI we shall discuss further in detail the delicate reactions of plants as well as the higher kingdoms of Nature to the force-complex surrounding them. Research which proposes to reach an exact understanding of the causes of many of the most essential phenomena in organisms will in future necessarily *explore thoroughly and concretely the action of planetary etheric spheres upon the field of force of the earth organism and thereby also upon the various organisms of plant, animal, and man,* in order that it may truly understand the specific differentiations in the evolution of the kingdoms of Nature, of species, and of individuals (Chap. XI).

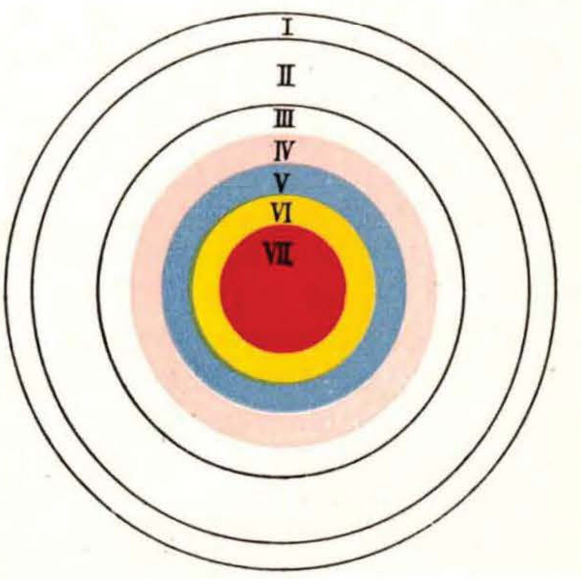
The Interior of the Earth

In order that we may complete the general and particular conception we have formed of the action of the etheric forces, we shall now take up a special question which is of great importance for an adequate understanding of the processes within the earth organism: the systematic arrangement of the interior of the earth.



We have already seen, that the accompanying diagram can schematically be taken to represent the basic structure as a whole.

In considering the interior of the earth in detail, this arrangement is modified furthermore, only in the following special manner. The solid body of the earth is the sphere of action of the life ether, whose tendency, in fact, is to bring about the solid state of aggregation of substance. But within this sphere of the life ether the other etheric forces also are naturally active, though in graduated modifications. The conception derived from our study of this, which the most recent experimental research entirely confirms, is as follows :—



I and VII Warmth ether. II and VI Light ether. III and V Chemical ether. IV Life ether.

The sphere filled in with pink is the solid earth—that is, the chief sphere of action of life ether. Naturally, life ether in small quantity enters also into the atmosphere ; indeed, it is this which holds the atmosphere together by its suctional action, since otherwise—in accordance with the tendency of light and warmth ether and the gaseous substances adapted to these—the atmosphere would fly away into cosmic space. That the force which holds together the earth and its atmosphere is not of a fixed and mechanical nature, but is subject to continual changes, we have seen principally in discussion of the variability of " gravitation," terrestrial magnetism, the double wave of barometric pressure, the rise and fall of water in the vegetable kingdom, the inhaling and exhaling of chemical ether by the earth organism, etc., so that the chemical ether also works in rhythmic alternation within and without the solid earth. In a more thorough consideration of the interior of the earth we must emphasize the fact that the different etheric forces working in the interior of the earth are subject, so to speak, to the general primary influence of the life ether, which interpenetrates the four inner spheres (IV—VII), but is modified by the other etheric forces in various ways—so that, for example, there are active in the fifth sphere life ether plus chemical ether ; in the sixth sphere life ether plus light ether ; in the seventh sphere life ether plus warmth ether.

These various modifications of forces also correspond to the various modifications of substance in the different spheres of the interior of the earth.

That the interior of the earth consists of a solid shell which passes over, as we approach the centre, to the liquid (lava, etc.), gaseous and fiery states of substance—that is, to modifications in the reciprocal action of life ether with chemical, light, and warmth ether—this is conclusively established by the combined results of practical scientific observation in connection with volcanoes, eruptive rock, etc. Only, the effort is generally made, for instance, to explain the fact that heat increases toward the middle of the earth and is at its maximum in the innermost centre, on the basis of chemical and mechanical causes alone. But Professor E. Kayser, in his modern " Lehrbuch der Geologie,"* says in regard to this (p. 77) : " An explanation of the internal heat of the earth by chemical processes occurred first to Davy. Two different phenomena came especially under consideration in explaining the heating of the upper parts of the solid earth—that is, oxidation and the formation of carbonates. It is clear, however, that, if the heat of the earth were really explained in this way, it must gradually decrease toward the centre, since the oxygen and carbonic acid from the water seeping into the crust would necessarily have been gradually exhausted. But, instead, we find the exact opposite : that is, a decrease in the internal heat as we move upward. . . . But, as regards the assertion that the heat of the earth arises from the pressure of the upper strata upon the lower, it has been shown through calculations by Pfaff that the mean temperature of rock, at a depth of 780 metres, could thereby increase at most by reason of pressure 1/113° (Celsius). . . . These discussions show adequately how far from fortunate are the attempts to explain the store of heat of the inner earth upon the assumption of chemical and mechanical phenomena."

The heat of the inner earth, in reality, is most intense at the centre and decreases as we move outward, not because of any sort of chemical or mechanical causes, but for the reason that the sphere of warmth ether lies at the centre of the earth, and is surrounded and modified by the other etheric spheres as we proceed outward (see diagram, p. 93). The normal arrangement of the etheric spheres, as shown above, is the true cause of the various states of aggregation in the interior of the earth organism. Chemical and mechanical hypotheses in regard to these things have almost always led within a short time to wrong conclusions. Only the theory of ether can help us to introduce system and meaning into the confusing multiplicity of such phenomena. *For the etheric structure of the earth organism is the primary thing, the structure of substance only secondary.*

Professor A. Nippoldt says in " Erdmagnetismus, Erdstrom und Polarlicht " (p. 51) : " The core is formed of glowing-hot gases of iron, nickel, and cobalt. The middle strata contain these metals in molten condition ; the outer shell constitutes a covering of rock. In spite of its high temperature, the core would be capable of being magnetised under the coinciding high pressure (of 2—3 million atmospheres), as it consists of most intensely magnetic substances. At all events, the fact that the sun, likewise glowing-hot, is magnetic points to the possibility that the inner core of the earth also can be magnetized in the same way." The difficulty faced by previous research—as here indicated—will find its solution in that distribution of the formative forces in the interior of the earth which we have explained, if the reader will at the same time recall that we have explained the phenomena of magnetism on the basis of characteristics of the life ether. The difference between the sun and the inner earth consists in this, that in the sun the life ether works only as a free etheric force and therefore induces the tremendous magnetic intensity of the sun, whereas in the inner earth it works reciprocally with substance and therewith produces the solid state of aggregation of the fourth sphere (shell of the earth) adapted to the life ether, or else produces modifications of this through the co-operation of the other formative forces toward the centre.

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* E. F. H. Kayser, Lehrbuch der Geologie, 5, Aufl, Stuttgart, 1918.

The above representation of the differentiated distribution of the etheric forces illustrates one of the most significant primal phenomena in the cosmos. We see (diagram, p. 93) that the third sphere corresponds with the fifth sphere (chemical ether inside and outside the solid earth); the second corresponds with the sixth (light ether); the first with the seventh (warmth ether); whereas the life ether (fourth sphere), in the modifications given above, inter-penetrates the whole and keeps all together. To what extent this important rhythm—1=7; 2=6; 3=5; 4; which here lies at the base of the etheric structure of the earth organism also plays an important rôle in the origin of other organisms and other phenomena of our cosmic system—of this we shall be able to speak in Chapters III and XI, as well as the second volume of this book, in connection with other groups of related questions. A general principle of conformity to law which has here been reached with regard to the articulation of our earth can also be followed out through all the kingdoms of Nature—indeed, even into the laws of evolution and the rhythms in periods of human culture.

The following systematic arrangement is also very important as regards the evolution of our macrocosm:—Each of the zones of chemical ether, light ether and warmth ether in the earth organism will be seen, upon more thorough future observation, to be further divided into three sub-divisions so that we now have to deal with *nine spheres of the inner earth* and correspondingly with *nine spheres of the outside of the earth.* Dr. Rudolf Steiner long ago gave a special description of these nine spheres. Since a discussion of these extremely interesting facts would require us to draw upon other branches of knowledge too extensively for the present survey, which is wholly from the etheric point of view, we must for the moment regretfully refrain from such a discussion.

If we observe the interior and the exterior of the earth, we may say *that the inner earth presents in respect to the distribution of its etheric forces a complete reversal, a turning upside down, of the etheric structure of the earth organism prevailing outside the shell of the earth* (see diagram, p. 93).

Sphere 1=7 Warmth ether
Sphere 2=6 Light ether
Sphere 3=5 Chemical ether
Sphere 4 Life ether

We shall see later (Chaps. III and XI) that this primal phenomenon, the reversal, the turning upside down, of the etheric structure from without inwards is repeated in the case of other macrocosmic and microcosmic organisms.

The Metamorphosis of the Etheric Formative Forces in the Planetary System

From the most remote times, men have looked upon Saturn as the outermost planet of our solar system. On the grounds already mentioned, Uranus and Neptune are left out of consideration. Modern astronomy faces an unsolved problem in the unique structure of the ring of Saturn ; and we shall see how the constitution of this ring, clearly established by means of modern instruments, is now readily understood on the basis of the theory of ether here set forth.

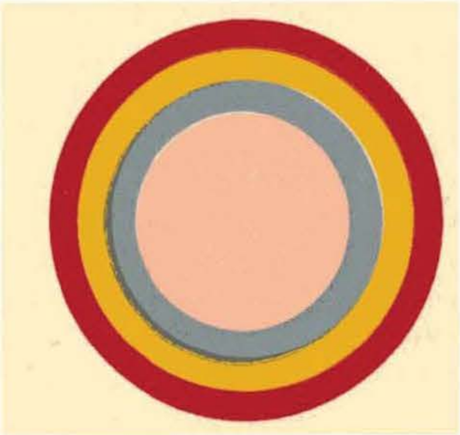
In his excellent work " Himmelskunde : Versuch einer methodischen Einführung in die Hauptlehren der Astronomie," Professor Josef Plassmann says (p. 378) : " Not only to the astronomical investigator of the observatory, but also to the mathematical astronomer, the rings present great difficulties. They cannot be any hard and fast structures ; for if such were the case, then, unless they were absolutely centred, they would crash down upon the planet. But, even if they were so placed at one moment that equipoise prevailed among the attracting forces, this condition could have no duration because of the motions of the satellites. The hypothesis of a fluid or airy state of aggregation offers similar difficulties." And in another passage : " The gradual decrease in the intensity of light in the ring from without inward and at the same time the existence of an area through which the globe is unbrokenly visible, teaches us that the density decreases from without inward."

In Chapter II., while discussing the states of aggregation, we learned to recognize that state of substance which exists beyond the solid, liquid, and gaseous as the " warmth-ether state " which is called in spiritual science also (phylogenetically) the " Saturn state." The fact established by modern astronomy, as Professor Plassmann states it, that " the hypothesis of a fluid or airy state of aggregation offers similar difficulties " in explaining Saturn, as does obviously the hypothesis of a solid state, affords additional foundation for our view which represents Saturn as a warmth-ether body.

It has been established, then, through contemporary astronomy:

1. That Saturn must be in a state of aggregation which is higher than the solid, liquid, and gaseous states.
2. That the *intensity* of light in the ring of Saturn decreases from without inward.
3. That the *density* likewise decreases toward the inner part.

Etheric Structure of Earth:



🟥 Warmth ether
🟨 Light ether
⬜ Chemical ether
🟫 Life ether

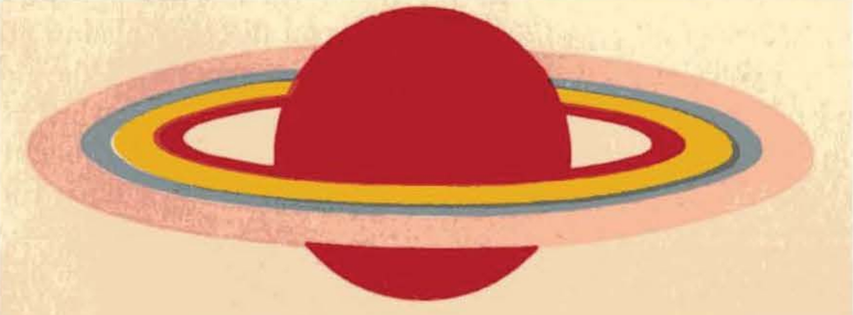
Research in distribution of the etheric formative forces now offers us the possibility of explaining systematically all these phenomena of Saturn.

We have already set up the articulation of the etheric formative forces shown in the accompanying diagram as basic for all phenomena of the earth organism.

If now, we wish to understand Saturn, we must completely reverse this structure, turn it upside down; so that Saturn, with its ring, presents the following picture.

Etheric Structure of Saturn:

= Reverse of the structure of the earth.)



The picture corresponds with all the phenomena hitherto mentioned, fitting indeed perfectly the most recent hypotheses of astronomy concerning the planet Saturn (see Plassmann "Himmelskunde," p. 376, etc.). Moreover, the difficulties met with in explaining the diminution in the intensity of light and in density from without inward are thereby removed.

Warmth ether, which produces a state of aggregation beyond the solid, liquid, and gaseous states (Chap. II), fills the whole planetary body of Saturn, as well as the inner portion of the ring. The four encircling zones are dominated as follows in their order from within outward.

Warmth ether	innermost zone of the ring
Light ether	
Chemical ether	
Life ether	outermost zone of the ring

As life ether tends towards the densest and warmth ether the most rarefied states of aggregation of substance (Chap. II), we find the structure of Saturn and its rings as shown in the above diagram completely confirmed by modern astronomy in its dictum that the density of substance in the case of Saturn diminishes from without inward. In studying the theory of light (Chap. VII), we shall come to recognise life ether and light ether as the indispensable pre-requisite of the phenomena of light; and to establish the fact that warmth ether in itself does not emit light. Since, now, modern astronomy has established the fact that Saturn shines brightest in the outer zones of its ring, and within does not shine,* therefore all these phenomena are a reciprocal confirmation of the etheric structure of Saturn as shown in the preceding diagram.

But the right knowledge of the etheric structure of Saturn is of decisive importance for a knowledge of the genesis of our entire cosmic system. *The etheric structure of the earth is a complete reversal, a turning upside down, of the etheric structure of Saturn. That which is "without" for the heavenly body oldest in its nature is for the earth "within," and that which is "within" for Saturn is "without" to the earth.*

But the inversion which puts the inside out and the outside in is a fundamental law of all evolution, which we can discover again and again at decisive evolutionary turning points in the process of development of organisms in all the natural kingdoms. Very often, when a living organism in its evolution (phylogenetic and ontogenetic) mounts to a higher stage, this happens through such an inversion, the inner becoming outer and the outer inner, whereby the totality of the vital relationships of the organism or of a part of it comes under new and entirely different evolutionary conditions. (For details see Chap. XI.)

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* Professor Plassmann says, p. 375: "The ring is distinctly brighter than the planet. It shines with a golden yellow colour while Saturn is leaden grey," and elsewhere: "Diminution of the brightness of the ring from without inward," p. 378.

The inversion of the etheric structure of Saturn as compared with the etheric structure of the earth is, therefore, one of the most sublime prototypes that we can behold in the macrocosm, enabling us to understand the nature of the evolution of the world of living organisms. *The etheric structure of Saturn is a first model of the whole world,* a model whose metamorphosis we are able to follow in the case of the other planets.

The formative force which was first in phylogenetic evolution, the *warmth ether* (Chap. II), *forms the body of Saturn,* while the genetically *more highly evolved formative forces, light ether, chemical ether, and life ether are radiated down upon the planet from its environment,* the ring. In the case of the earth, the formative force which is genetically *most highly evolved,* life ether, forms, in absolute contrast with this, *the inner part of the planet*; while *the least evolved,* warmth ether, forms *the outer part,* and enters the inner part of the earth in a form modified by the life ether. *The sun,* between Saturn and the earth, is filled exclusively by the formative force genetically most highly evolved, the life ether.

Thus the macrocosm brings before our eyes in a vast picture the metamorphosis of " inner " and " outer " as a symbol of all evolution.

	Least evolved etheric formative force, Warmth ether :	Most highly evolved etheric formative force, Life ether :
Saturn	Inside	Outside
Sun		Completely filled
Earth	Outside	Inside

But we can view this process of inversion, not only in the relation between Saturn and Earth, but also again in the organism of the earth itself, the most complex of all planets.

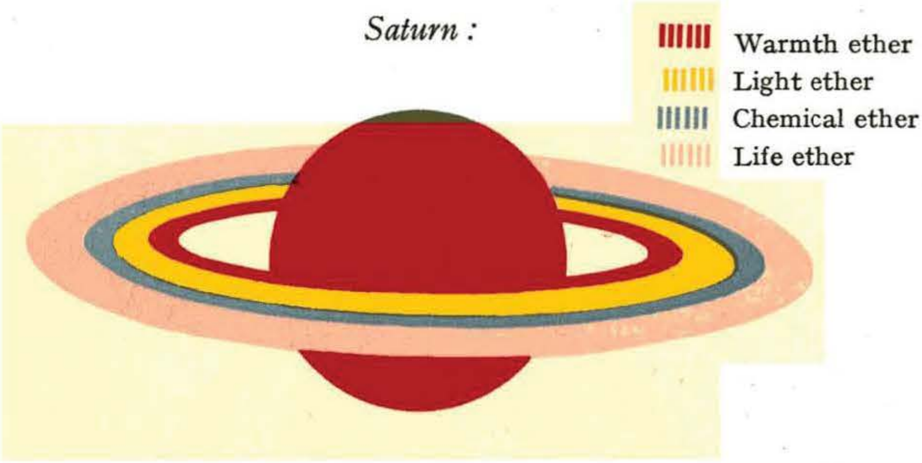
If we recall the etheric structure of the inner earth as previously given and as confirmed by the phenomena, we observe that *what is shut up in the interior within the solid crust of the earth (life ether), represents an inversion, a turning upside down, of the structure which the earth organism shows outside the solid crust.* The spheres succeed one another, as we have shown (p. 93) in the following order :

1. Warmth ether 2. Light ether 3. Chemical ether		*Outside of earth* (Atmosphere)
4. Life ether		Solid earth
5. Chemical ether 6. Light ether 7. Warmth ether	Here modified by life ether	*Interior of earth*

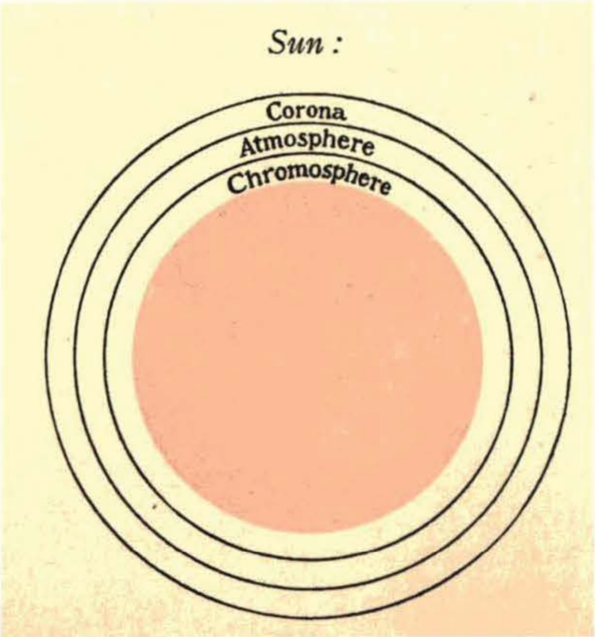
Wherein 1=7
2=6
3=5
4

This tremendous metamorphosis of the outer to the inner and the inner to the outer by action of the etheric formative forces in the macrocosm is illustrated in the following pictures:

Saturn :

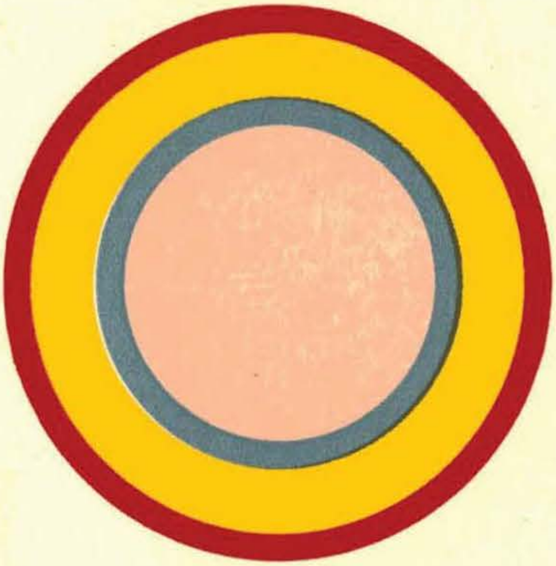

Warmth ether
Light ether
Chemical ether
Life ether

Sun :

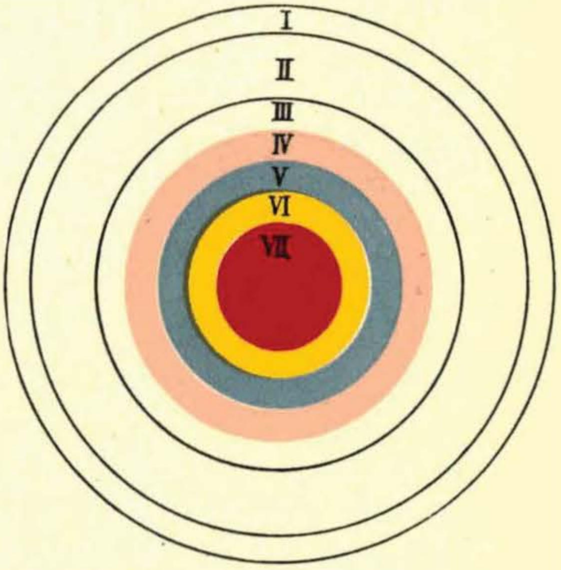

Corona
Atmosphere
Chromosphere

Earth:

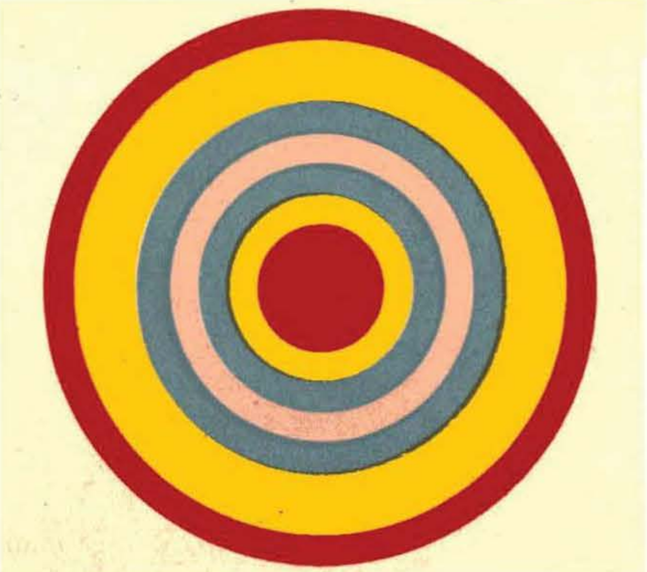
Reversal of the etheric structure of Saturn to that of the earth:



Interior of the earth differentiated (Reversal of exterior)



Earth with its Interior (represented as differentiated)



In the second volume we shall indicate the relation of the other planets to the etheric formative forces, and we shall be able to observe in succession how these rhythms and processes of metamorphosis of the macrocosm, are reflected even in the world of the micro-organisms and are active even there (see also Chap. XI).

The Etheric Organism of the Earth and of Man

We will now combine the conceptions we have formed of the activity of the etheric formative forces in the cosmos, in the earth organism, and in the various kingdoms of Nature. We perceive that man does not simply possess a physical body of dead substance, but is penetrated and woven through by forces which build up his physical body and which also make him a member in that great rhythmic life process of the earth organism; that the life phenomena in the kingdoms of Nature present themselves to us as a picture of the restless activity of the most manifold forces, the eternal metamorphosis of that "which has been, is, and ever shall be." Very few persons clearly grasp the fact that in a relatively brief space of time, in a rhythm of about seven years, most of the substances which now compose their bodies will have ceased to belong to these bodies; that these substances will then be scattered in the life processes of the other kingdoms of Nature, to be replaced in turn by new substances. How few there are who earnestly think through to the end the thought that in reality my own hand, which I can now touch, will in a few years no longer—so far as concerns the substance—belong to me, because the circulation of the blood and the breathing and many other life processes will then have replaced with new substance the flesh which I now feel upon myself; that the substance which composes our physical body is continually, as it were, being washed away and replaced with new material from the kingdom of Nature, the new in time being subject to the same eternal change.

And yet this body, eternally transmuted in its components, keeps as a whole its form, the human form, and still is held together as a unity by a structure of forces which place this entity of materials and forces before us as the form of an individual man just in the way that we perceive it. If that which is carrying on this eternal process of renewal withdraws from the human body, as happens in the case of a corpse, there falls away also the form which holds the substance together and which constitutes the picture of man. That which renders possible the life phenomena in man, in that it keeps the substance in eternal metamorphosis, is those etheric forces which interpenetrate and interweave the physical body. We have already shown by many examples that he who would understand the action of forces on the basis of a concept of "electrons," as the quantitative-mechanical world conception has framed this, will never reach the goal sought by his understanding.

Just as we speak of a physical human body, under which term we include the sum of all substances composing this body, although in constant flux, so also that sum-total of etheric formative forces which produce the life processes and the evolution of substance in the human body we may indicate comprehensively as the *etheric or formative-force body* of each man. Anthroposophically orientated spiritual science consequently calls this part of the human being the " ether body " of man.

But the human being is not yet explained even through both the physical body and the ether body. In the introductory chapter we have seen, for instance, that motion processes which man as such carries out depend upon a great number of factors : that is, upon an *ego,* which *wills,* upon a transmitter of this volition or impulse, which transmitter consists of the world of force as we have learned to recognize it in the etheric formative forces ; and lastly upon a substantial thing moved—for example, the arm of the man. We also reached the conclusion that motion-events in the kingdoms of Nature are not to be understood except on the basis that an impulse of will as ultimate first cause gave the initial *thrust thereto, as is the case with the willing ego in the instance of the human being who moves his arm.* Here, then, there are etheric occurrences linked up on one side with states of consciousness and expressions of will, on the other with occurrences in the world of substance. The reciprocal operation of the etheric in its great cosmic and terrestrial activities and currents with states of consciousness in the kingdom of Nature, with man awake and asleep, with animals awake and asleep, etc.—this we have learned to recognise in considering the direction of the vertebral column in man and in the animal. We have, furthermore, observed the great rhythmic life-processes as the work of the etheric formative forces in the earth organism and followed these in numerous manifestations of their activity, always recognizing the association of this process with the most diverse states of consciousness in the kingdoms of Nature.

Indeed, we must now arrive at a conclusion which, following after the mechanistic conception of the world—a conception, too, that often manifests itself in currents of thought where we ourselves are quite unaware of it—will give rise to strong opposition on the part of materialistic and mechanistic thinkers of the present age. And yet what here follows is not only a reality open to research but also the necessary conclusion resulting from a logically exact and consecutive course of reasoning which does not hesitate courageously to throw overboard habits of thought that have grown to be dear and comforting—especially if such habits of thought bring one to the " limitations of the knowledge of Nature."

The world conception of this materialistic age is anthropocentric just where it should not be and is not anthropocentric just where it should be. That is, it orientates the world by reference to man in matters where such orientation is nonsense—a nonsense deriving partly from vanity—and it does not orientate the world by reference to the being of man in matters where the being of man is, beyond all doubt, decisive and characteristic for the whole combined process of cosmic evolution.

A form of observation of the first category is the view that has been formed regarding the connection of consciousness with cosmic processes. In this matter lies the great difference between the system of thought of great thinkers such as Kepler, Galileo, Goethe, etc., and the diligent detailed specialistic labour of a materialistic age. This age has taken up its position on the point of view that phenomena of consciousness are linked up with the manifestations of force and processes of life and motion only in the human and animal organisms, and this solely on the ground that we do not yet possess any adequate knowledge of phenomena of consciousness associated with the manifestations of force and processes of life and motion in the happenings in the rest of the cosmos. While at present men admit this association of a state of consciousness of any kind only in the case of man himself and—though this latter is very vaguely conceived—in the case of animals, those who should maintain the existence of a reciprocal relation of any sort whatever between other phenomena in the phenomenal world, on the one hand, and states of consciousness on the other, or who should wish to include such a thing within the field of their research, would be journalistically and rhetorically burned at the stake as heretics in science, sinners against scientific dogmas, just as Galileo and others were threatened. Especially would this be true of any one who should assert the concrete existence and action of beings possessed of a higher state of consciousness than the objective consciousness of the men of our age. Nevertheless, accurate thinking, free from preconceptions, compels one to consider as an anthropocentric world-concept of the most arbitrary kind the assertion—no matter whether it arises from habit or excessively materialistic attitude of mind—that the manifestations of force, the processes of life and motion, are associated with phenomena of consciousness in human and animal organisms alone. Obviously it would be nonsensical to attribute the same state of consciousness which comes about in the human organism with its own special structure also to such organisms as possess, for example, an entirely different physical or etheric structure. Already, in considering the direction of the vertebral column in the kingdoms of Nature, we have seen how this reciprocal action between the etheric phenomena and states of consciousness undergoes the most varied modifications, and the dream consciousness and deep-sleep consciousness of man in his reclining posture while asleep are, to the scientific understanding of this mechanistic-materialistic age, a book sealed with seven seals. In the presence of these things, as we have already shown in the introduction, the high-minded and courageous investigator recognizes only two possible alternatives: (1) the openly avowed " ignorabimus " for all time; or (2) this question:—Are there methods scientifically exact whereby we may come to know and to investigate states of consciousness which are of a different sort—whether higher or lower—from the really narrowly limited objective consciousness of the men of our age? (See also Chap. I, pp. 28-32).

Furthermore, however, we must say that a real knowledge of the processes of Nature in its entities will never be possible unless in some way this question is answered affirmatively. Anthroposophically orientated spiritual science answers " Yes " to this question, and anyone who is in earnest possesses the possibility, by means of exact methods explained in the works of Dr. Rudolf Steiner, of extending the field of his research into territories which lie beyond the limits of a knowledge of Nature characteristic of this mechanistic and materialistic age. If, however, he will not do this, he still has the further possibilities of testing that which is asserted from supersensible understanding in regard to phenomena of the sense world, and he will find these assertions wholly confirmed.

We have seen that the living earth organism shows an etheric system of forces in which processes of breathing and circulation take place corresponding to similar life-processes in the human organism, and in a reciprocal relationship with these (see the numerical relationship between life processes in Man and Cosmos, as expressed in the figures 25920, etc., p. 49). Therefore, just as we point to the system of forces in each individual human organism as the " ether body " of the man, so also we must look upon the earth organism as consisting of a physical body and an " ether body of the earth," which comprises its etheric formative forces. As in the case of the human organism, so also in that of the living earth organism, it is the " ether body " which calls the phenomena of life into existence and which regulates and metamorphoses them.

Accurate, logical thinking will finally recognize the truth that, just as in the case of certain motions of the human body there are revealed the act of will and associated states of consciousness of a being,—man,—who induces this motion of the physical body through the medium of the etheric body (movement of an arm, etc.), so likewise, the motion-events of other organisms, great or small, in the cosmos receive their initial thrust through an act of will whose association with states of consciousness, however, man will and must slowly seek to learn. The conception of a dead cosmos held by a materialistic age, which viewed the earth as a mere globe of substance rotating by reason of forces of hypothetical and unknown origin, runs counter to the fact that there is a living, thinking man in this cosmos, and narrows the boundaries of human knowledge of Nature more and more as one endeavours to penetrate more deeply into the being of Nature on the basis of such a view. The cosmos grasped as a world-organism, the product of active spiritual entities, as a world of organisms whose vital phenomena are the work of the harmonious metamorphosis of etheric formative forces—not of dead mechanical vibrations—this is a world concept wherein the living, thinking man with his conscious acts of will, with his ether body kept in rhythm and motion by the etheric formative forces, and his material body in constant flux up to the very moment of death, finds also his interpretation and meaning. Before the young generation of the future, rejoicing in research and bold in understanding, there open up here perspectives which alone can help us past the general sense of resignation of science in the decadence of this materialistic-mechanical age.

This younger generation, which rebels against the results of the mechanistic world concept as these appear in the present time, I would counsel to read the noble work of Johann Kepler " The Harmonies of the Universe " (Harmonices Mundi)*—of that Kepler of whose spacious system of thought the present age has taken over only the dead skeleton of the three laws of Kepler, not the soul and life of Kepler's system of thought, which belong inseparably to these three laws, as the whole being of man belongs with his skeleton. Should Kepler rise again among us, he would shudder to realize what the present age has made of his work. While there are many details in that work now out of date, and its general direction has rightly been modified, that which distinguishes Kepler most profoundly from many of his successors is his attitude toward the spiritual as a reality.

Johann Kepler in his work " The Harmonies of the Universe " says:

> " We shall now speak of the existence of a soul of
> the earth as of something fully established, and
> shall proceed to investigate its character."

Goethe: The Earth Spirit to Faust:

> " In the storms of action, the floods of life
> I surge and sway
> Above and below
> Hither, thither, to and fro.
> Birth and death, an infinite sea,
> A web that changes eternally,
> A living fire!
> I work at the loom of Time, I smite with the weaver's rod,
> In the whirr and the roar I fashion the living garment of God."

(From " Goethe and Faust," by F. M. Stawell and
G. L. Dickinson, London, 1928).

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* Johann Kepler, Harmonices Mundi, Lintz, 1619.

Chapter IV

THE ONTOGENETIC ORIGIN AND DISAPPEARANCE OF SUBSTANCE

TWO great basic thoughts rendered incalculable service to Goethe, the highly gifted investigator, in his way toward an understanding of Nature : the concept of " *polarity* " and that of " *intensification* " in the phenomenal world. This phenomenal world is interpenetrated by the world of formative forces, as we have endeavoured to view them, those forces whose spontaneous activity Du Bois Reymond once introduced as the subject matter of his *second world riddle*, the *origin of motion* in the cosmos. In fact, we not only observe in Nature a spontaneous working of the force world—uninfluenced for the most part by man, for which we may be thankful—but we see also that this working proceeds according to inner laws and tendencies. Indeed, we might even say it proceeds according to a " plan," into whose spirit, however, he who accepts the philistine philosophy of many a Darwinian, with its " natural selection " and the " struggle for existence," will never be able to penetrate. We perceive that the metamorphosis of states does not merely carry through a meaningless transition from one arbitrary state to some other arbitrary state, but that metamorphosis in the phenomenal world, viewed comprehensively, brings to pass generally an " ascent " of the evolutionary forms and capacities according to spiritual laws. Since it has been discovered, however, during the last decade in connection with processes of radio-activity, that the *material world is subject also to an inevitable and systematic decay*, the question must again arise whether the " ascent "—the upward evolution of the material world—has any meaning at all when the decay of substance must inevitably lead again backward to the final ruin of this work. In the following chapters we shall seek to show that such a pessimistic conception is possible only when we restrict our observation of Nature one-sidedly to a view of the origin and disappearance of substance, instead of investigating the concrete reciprocal activity between the spiritual and the material in its full reality.

Professors St. Meyer and E. von Schweidler write in their remarkable work already cited, " Radioaktivität " : " In the metamorphosis of the radio-active elements we witness a spontaneous transmutation of matter in which the individual radio-active products constitute barely stable halting places ; this proves that *individual elements are capable of metamorphosis.* Yet in this connection the fact must be strongly emphasized that up to the present we have not been able by any physical or chemical means to hasten these metamorphoses, to retard them, or to influence them in any way in the one-sided direction of their course, much less to reverse the process. Whether, however, in these radio-active substances we are obliged to view, as powerless spectators, the gradual decay of chemical values in one direction, or *whether in general a rebuilding of the most complicated chemical elements is at the same time proceeding in a manner quite unknown to us,* is surely one of the most crucial of questions." The discovery of the spontaneous radio-active decay of substance, with its associated phenomena, has until now shaken pitilessly the very foundation of the doctrine of the conservation of matter and of force, and the advocates of this view—which holds good for only a part of the world—have been driven to a frenzy of defensive theories, in which there is often something tragic.

We will seek to form a conception of the relation between the force world and the material world, which, indeed, it is possible to distinguish from one another only schematically, and not so sharply in reality. We have found that the etheric formative forces of the earth organism, the ether body of the earth, are influenced by two fundamental etheric currents of force in the cosmos ; that is, by the life ether streaming to us most of all from the sun, and the chemical ether radiated to us chiefly from the moon, with their respective vertical and horizontal directions of currents. The more recent scientific research has now made the exceedingly important discovery that the most abundant substances in the outermost strata of the atmosphere are helium and hydrogen. Moreover, we have learned to recognize oxygen as the most important ingredient in the atmosphere, so that we may look upon hydrogen and oxygen as two of the most essential basic elements in the material world. Moreover, our *process of breathing* and our *circulatory process* are fundamentally dependent upon oxygen and its modifications and upon the watery state of the blood. We shall see in the following chapters, and most of all in the discussion of light (Chaps. VII. and XII.), that there has not yet been a thorough-going study of the profound and essential differences between the various forms of oxygen. For we shall learn that the entity two-fold oxygen* is distinguished always from the entity three-fold oxygen, not only in that oxygen at one time enters into this combination and another time into the other combination *but that the difference between these two entities is most intimately connected with the pheonomena of life and death.* For the most important point here is, not the number of the units of oxygen combined, but much more this question : What forces bring about, on the one hand, the combination 0_3, and what forces the combination 0_2; and what forces are linked, therefore, in their activity with the presence of the substance-structure 0_3 at one time, or the substance-structure 0_2 at another ?

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* For reasons growing out of the certain aspects in the discussion, the author uses the terms *zweifach* and *dreifach* instead of the usual *zweiatomig* and *dreiatomig*.

If we now clarify our minds as to the ontogenetic origin of substance, we shall find the following to be true of the earth organism, in which the two etheric formative forces, life ether from the sun and chemical ether from the moon, are active. (Diagram p. 110.)

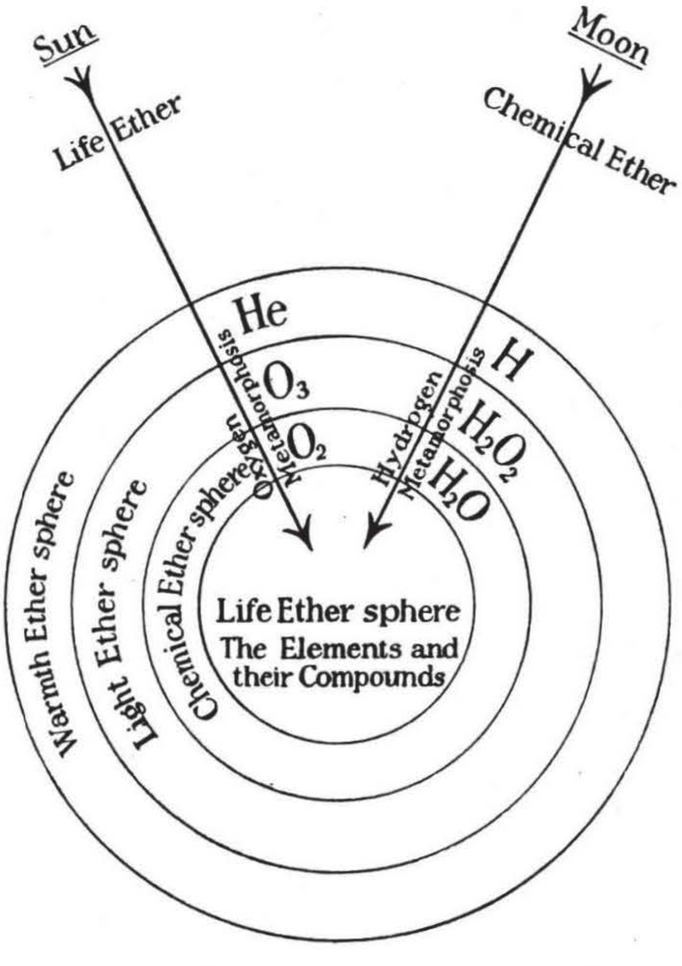
1. Experimental research establishes the fact that the substance which makes its appearance in the *vanishing* of matter, in its spontaneous radio-active decay, is the same as that which we discover at the boundaries of our earth-organism, in the *coming into existence* of matter : that is, helium (He).

2. When the forces radiated inward into the earth organism penetrate more deeply into the material world, the sun force then forms ozone, threefold oxygen, in reciprocal action with the forces and substances of the light-ether sphere of the earth organism. Dr. K. Kähler, of the Potsdam Meteorological Observatory, says in his book " Luftelektrizität," so rich in significant facts, that there " is thus indicated a mutual dependence between *a* (the intensity of electricity diffused in the atmosphere) and the ozone content of the air. With the increase of *a*, the ozone content also becomes greater. We have to do here, at least, with an indirect relation which seems to be attributable to the rays of the sun." And elsewhere (p. 140) : " Another source of electricity, chiefly important for the uppermost strata of the atmosphere is the ultra-violet sunlight. . . . It produces ozone."

On the basis of a concrete following out of the activity of the etheric formative forces we will express the matter thus : The life ether radiated from the sun into the earth organism forms in the light-ether sphere ozone, the threefold oxygen.

We shall find this formation of ozone in the study of light (Chap. VII), as well as in connection with the process of radio-activity, and finally we shall see it in the study of the human organism (Chap. XII) associated with the appearance of the most important phenomena of life. That ozone appears most of all in the highest strata of the earth organism has been shown by experimental research. But the views in regard to ozone in scientific writings are strongly at variance with one another. Some call it " a poisonous gas "; others " an especially health-giving ingredient of the air."

The important distinction between the oxygen in the threefold state on the one hand, with which are associated, as we shall later see, the most essential life phenomena of the human and the earth organism, and oxygen in the twofold state on the other, will in future play an important rôle in many phases of the study of organisms.

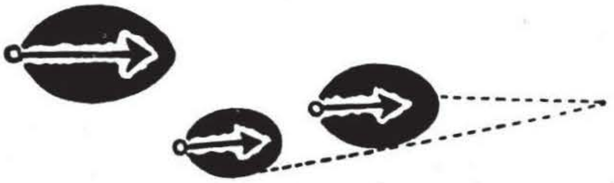

Sun
Life Ether
Moon
Chemical Ether
He
H
O_3
O_2
H_2O_2
H_2O
Oxygen Metamorphosis
Hydrogen Metamorphosis
Warmth Ether sphere
Light Ether sphere
Chemical Ether sphere
Life Ether sphere
The Elements and their Compounds

In the same spheres of the earth in which the life ether of the sun forms ozone, or threefold oxygen, the chemical ether (of both the moon's radiation and also the earth's radiation) forms hydrogen peroxide, (H_2O_2). In view of the intimate association of this substance with processes in the human organism, this also will play a great rôle in future organic research. Here, then, we should fix firmly in our minds that these two substances, threefold oxygen and hydrogen peroxide, so intimately connected with the phenomena of life, have come into existence by reason of the penetration of the sun forces (life ether) and the moon forces (chemical ether) into the upper light-ether sphere of the earth organism.

3. When the cosmic forces penetrate more deeply into the material world of the earth organism—that is, when they approach the lower strata of the atmosphere and the solid earth (see diagram, p. 110), then comes into existence the twofold oxygen (O_2) which is the most essential ingredient for human breathing, and water (H_2O) as it streams down to us in rain and covers the surface of the earth, one of the most essential constituents of the vital juices in organisms (blood, etc.) and the great sustainer of the vegetable world.

In future, nevertheless, extreme care must be taken in carrying over the findings of laboratory research to phenomena assumed to be similar in the atmosphere and the cosmos. The error has occurred especially in reference to *the origin of water*—that is, the *formation of clouds*, in that phenomena observed or produced under laboratory conditions have been carried over to the atmosphere, which merely results in a caricature. Dr. K. Kähler is, therefore, quite right when he says in speaking of the condensation theory hitherto held, ("Luftelektrizität" p. 104): "As applied to the atmosphere, the drop-formation in an ascending stream of air would have to occur first in connection with motes of dust, then in connection with the negative, and last with the positive, carriers of electricity. But it is very questionable whether laboratory inquiry can be transferred to the atmosphere." And he comes to the conclusion (p. 146) that, according to investigations made, it is "improbable that in the upper strata of the atmosphere condensation takes place at all in connection with the carriers of electricity. Such hyper-saturation as is required by the theory has, moreover, never been proven to occur in the atmosphere. The condensation theory, therefore, will not explain the observed set of facts." It has thus been found that electricity is not the cause of the formation of water in the atmosphere of the earth. Dr. Rudolf Steiner has described the forming of water in the following manner: Let us suppose the air in the spheres of the earth organism in question to be filled with innumerable tiny vacuums (after the manner of the sun) in which there are suctional forces, which, when they issue from these vacuums, cause a drawing together, a condensing of the surrounding substance (water vapour).

Formation of water represented in a diagram:



Such a description gives a picture-form of what was meant in our discussion as to the kind of action of the suctional, concentrating forces, which, in the case of the formation of water in the clouds, is the action of chemical ether sucking together the water vapour and thickening it to water.

We must here distinguish sharply also between the formation of water and of clouds, on the one hand, where it is due to the action of cosmic forces radiated into the earth organism (chemical ether of the moon) and on the other hand such formation of water as results from the radiation of forces outwards from regions of the earth. We have already shown the mutual connection of the formation of water and clouds and the phenomena of the northern lights, the polar light (Chap. III), where likewise it is chemical ether which produced the water, but chemical ether radiated outward from the interior of the earth (see pp. 82-83).

4. If, now, we would investigate further the *phylogenetic and ontogenetic origin of substance,* we must proceed from the following points of view : Just as the crystal is a previously liquid form now become a mineralized solid, so also, for example, coal is the mineralized dead form of a once living, organic thing ; not the opposite—not that the organic is a living form arisen from what was previously inorganic, like the " homunculi " which hover before the learned pedant Wagner in Goethe's " Faust." In the coal deposits of our earth there appear before us the dead plant world of long past ages. Can a new plant arise out of the coal unless the life and formative forces take possession of the substance and out of themselves give it life and form ? Certainly not. The impulse of will which impels the etheric formative forces to the modelling, shaping, and vitalizing of substance is necessary to enable a new plant world, through the formation of the compounds of carbon or of albumen, etc., to come into being out of the dead plant world—the coal. *Clearly, therefore, the spiritual, that which is possessed of real being, is primary ; the phenomenal world of substance is secondary,* whether we view the question phylogenetically or ontogenetically, or otherwise. The horrible theories which have arisen through carrying the teaching of Haeckel too far have striven in vain to explain even man himself as a phenomenon arising from substance—that is, out of those compounds of carbon which we call albumen. The characterisation of the world of human thought as the " product of the vibration of the brain " crowned this noble work of occidental wisdom, which was entitled insultingly, " Man."

We shall understand man as well as the rest of the kingdoms of nature with all the phenomena of life, when we not only reckon with dead substances, electrons and ether vibrations in the cosmos, but are willing to take under specific observation the reciprocal working together of states of consciousness, living and active etheric formative forces, and the phenomena of matter metamorphosed by these forces within the cosmic and earth organisms in all their manifestations.

In Chapter X we shall be able to consider how substance—whose genesis, as we were able to see, is due to forces radiating from the cosmos as well as originating in the earth itself—again decays within the earth organism ; how, therefore, the eternal circuit of becoming and vanishing turns upon itself, the circuit within which are woven our cosmic system, our earth organism, and even ourselves.

Chapter V

THE RELATION BETWEEN THE WORLDS OF SPIRITUAL BEING, OF THE ETHERIC, OF SUBSTANCE, AND OF FORCE

IN order to arrive at a comprehensive conception of the relation between the worlds of pure spiritual being, the etheric formative forces, and the remaining worlds of force and substance, it may be well for me to endeavour at this point to touch upon an explanation given in a far more comprehensive manner by Dr. Rudolf Steiner in his second lecture course dealing with natural science, and to place this in relation with what has been said above as to the nature of the etheric.

Every substance of the phenomenal world has a definite degree of intensity in action*. We have learned to recognize the sun as a state, so to speak, of negative material intensity, as an omission within space otherwise all filled, as a space not filled with substance, in which, above all, the life ether force is at work in the most diverse ways and with the most varied attributes. We have to deal here, therefore, not with a thrusting action with the index outward, but with a suctional action. Furthermore, while considering the phenomena which occur in connection with the origin of the different states of aggregation (Chap. II), we have seen that both phylogenetically and ontogenetically a condensing process —with rhythmic repetitions—can be established, through which the etheric formative forces cause the genesis of substance, its maintenance, and its reduction, that is, its metamorphosis into another state. Since that which we are able to perceive with our sense organs in the phenomenal world consists only of " states and their transitions from one to another," the following can be regarded as the inter-relationship between pure spiritual being, the etheric formative forces, other forces, and the material world in its endless variations. (The genesis of individual and generic forms in the several kingdoms of Nature will be discussed in detail in Chapter XI). We stated at the beginning of this book that there are seven etheric formative forces, of which four realise themselves in the present phenomenal world:

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* See also, in connection with this problem, L. Kolisko : " Physiologischer und physikalischer Nachweis der Wirksamkeit kleinster Entitäten," Stuttgart, 1923, which opens a new direction of research in this field.

Being		
Mediating Forces	Life ether	Free etheric formative forces
	Chemical ether	
	Light ether	
Phenomenal World	Heat —(Warmth ether)	States in the phenomenal world caused by the etheric formative forces.
	Gaseous —(Light ether)	
	Fluid —(Chem. ether)	
Mediating Forces	Solid —(Life ether)	Forces united with substance (sub-material)
	Sub-field (Electricity)	
Being		

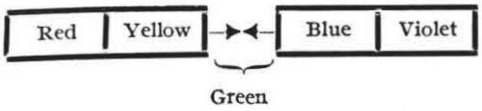
Beyond this tabulation we can do no more than indicate in this connection the following facts; since a more thorough elaboration would demand an entire volume. Below the condition spoken of as the phenomenal world, to which has been applied the much discussed term "matter" or "ponderable substance," there is classified in the above table a sub-field, or sub-material world. In this world of the sub-material belong all phenomena which we designate by the term "electricity"—although it is extremely difficult for any accurate thinker to give an adequate definition of the content of this concept. Since, however, electricity appears as a phenomenon everywhere, there are roads leading toward the possibility of mutual understanding regarding it. The phenomenal world of ponderable substance is thus, as it were, a *medium state extending between the force-activities of the etheric on one side and electricity on the other.* The state of substance at any time is the *result of this conflict between forces over the mutable world of substance.* If, now, we desire to understand the *phenomena of life,* it will not suffice, therefore, to reckon only with the action of substance and electricity. All endeavours to explain the phenomena of life on the basis of these two factors alone have always failed and will always fail. Professor A. Waller says in his "Vorlesungen über tierische Elektrizität," "An active voltaic element as well as active living matter surrounds itself with the products of its own activity, which products actually work against that activity. A comparison between polarization and depolarization of a voltaic element and the destruction and the rebuilding of living matter would probably not be any more forced or inaccurate than comparisons in general are." And elsewhere (p. 83) he states further that it has been shown in connection with investigation of "animal electricity" that the "*increase in capacity for polarization is notably greater in living matter* *than in dead.*" Yet with all these researches the utmost progress that has admittedly been attained has been to cause a pair of duly prepared frog's nerves to wince. Du Bois Reymond ended with a sad renunciation of all possibility of explaining the phenomena. For what does such research profit us if we must assume, to begin with, a great unknown, "active living matter," without ever being able to understand it? Henceforth, however, we know that "active living substance" is substance in which work the etheric formative forces.

Research into the phenomena of life requires, therefore, knowledge of the etheric formative forces, which first make of the "dead" substance moving living substance. Only with such knowledge shall we have laid one indispensable foundation for the understanding also of the phenomena of reciprocal action of "living matter" and electricity. Moreover, we must add that many recently discovered phenomena—for example certain phenomena of "radio-activity"—have been assigned to the field of "electricity" which in character do not by any means belong in this field but are of etheric character. The way to an understanding of the phenomena of life leads, in any case, elsewhere than through the phenomena of electricity alone; this is certainly the lesson to be drawn by every conscientious observer from all the findings of the last decade.

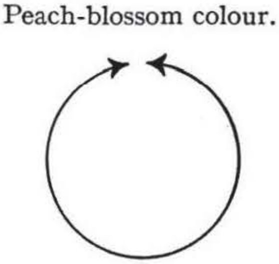
In his book "Meteorologie" Professor W. Trabert says: "When we cast a glance backward to the ultimate cause of all those changeful phenomena which take place in the atmosphere, these always lead us, in the last analysis, to the *sun as the primal source of all transformations on our earth.*"

Intercepted sunlight, when subjected to certain influences, shows us the spectrum which embraces the whole world of colour, *i.e.*, the totality of those endless variations in which we perceive the world of phenomena through the sense of sight, for the human sense of sight perceives everywhere only coloured forms and their transmutations. When, now, following an indication given by Dr. Steiner, the solar spectrum, which ordinarily appears as a straight band of colours, is bent into a circle, the following results. Just as the green appears in the usual spectrum only when the experiment is so arranged that the two inner poles of the yellow and the blue meet one another, so also at the junction of the two ends of the spectrum now bent into a circle, there occurs a new colour, which may be called "peach-blossom," the colour of the skin of the living human being.

Goethe commented on the investigation of the peach-blossom colour in his theory of colour, but he reached no conclusive results. Dr. Steiner has rendered a lasting service to science, through this discovery, whose true fruit only future generations will be able to understand and enjoy in its full significance.

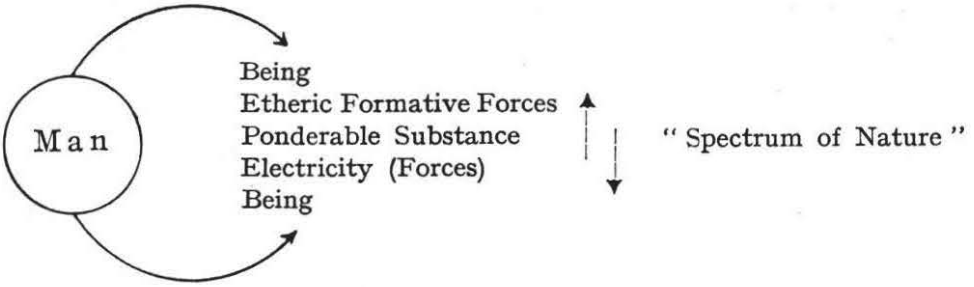

Red
Yellow
Blue
Violet
Green

The sun spectrum in straight line.

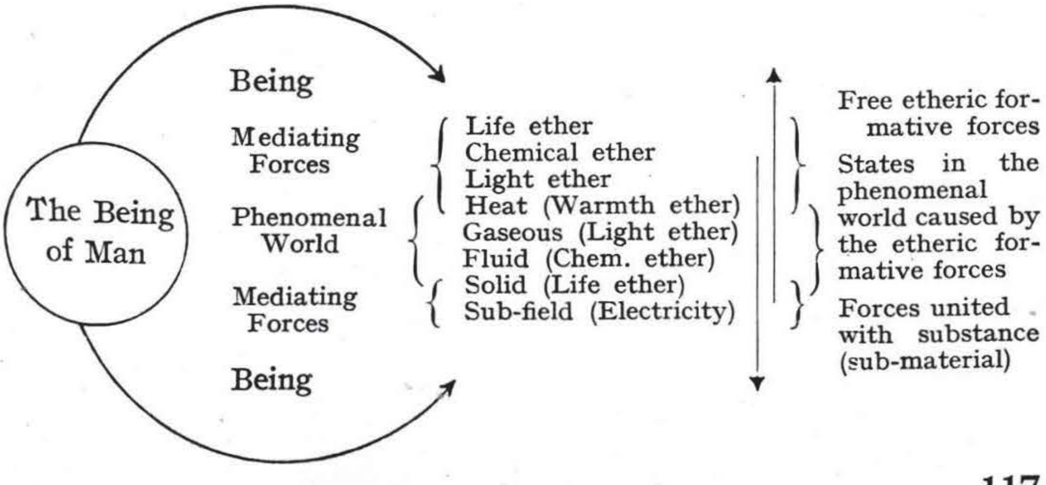

Peach-blossom colour.

The sun spectrum in a closed circle.

If we apply this idea of the circular spectrum to the great " spectrum of Nature " (Table p. 115) we perceive, as Dr. Steiner pointed out—uniting thereby physics, the theory of organisms, and metaphysics—that, when man as a thinking being experiences Nature, he then forms into a circle, as it were, the " spectrum of Nature," the junction point of which lies in his own spiritual being. As the sun spectrum embraces the sum of all the transmutations of the phenomenal world, so also the thinking man is on the way to embrace the spiritual spectrum in his knowledge, that spectrum which embraces the world of etheric formative forces, of ponderable substances, and of electricity, as these realms in turn reciprocally interpenetrate one another.


Man
Being
Etheric Formative Forces
Ponderable Substance
Electricity (Forces)
Being
" Spectrum of Nature "

if we make use of the above " spectrum " (p. 115) we arrive at


The Being of Man
Being
Mediating Forces
Phenomenal World
Mediating Forces
Being
Life ether
Chemical ether
Light ether
Heat (Warmth ether)
Gaseous (Light ether)
Fluid (Chem. ether)
Solid (Life ether)
Sub-field (Electricity)
Free etheric formative forces
States in the phenomenal world caused by the etheric formative forces
Forces united with substance (sub-material)

The reciprocal relation between the " world spectrum " and the phenomena of light and colour we shall be able to consider in further detail in Chapter VIII, when dealing with the theory of colour. In what manner the realm of heat has to serve as a sort of bridge between these several worlds, as appears in the foregoing diagram, and how man is fitted into the whole as a being belonging in special respects to all these various spheres in common, will become clear to us in the study of the human organism (Chap. XII).

The distinction between forces united with substance and those not so united is already understood to a certain extent by every investigator of radio-activity through the difference between the alpha, beta, and gamma rays, and to the chemist through the fact that positive electricity never occurs in the phenomenal world apart from matter. But these merely quantitative distinctions made from this direction of approach will not suffice when once research wishes to enter the sphere of the living.

All this can, of course, only be indicated in this connection ; its elaboration must be deferred to a future time. If we have once considered this " spectrum of Nature," it then becomes clear to us what a tremendous gain for knowledge Goethe held in promise when the significance of the conceptions " polarity " and " intensification " arose within him. In reality, the phenomenal world of the states of substance, viewed in the large, is to the mind of the observer never in a state of rest, but for ever in motion, in that perennial motion and transmutation which is due to the fact that the world of substance is in the grasp of polarically opposite forces which interpenetrate it, upbuilding or destroying—that is, contending for it. *The phenomenal world of substance is extended between the polaric extremes of two forces, the etheric formative forces on one side and the electric forces on the other.* But this world experiences also an ascent, an evolution ; for the spiritual, which lives in it, has not only created this phenomenal world cosmogenetically (involution), but also works in its development (evolution) according to spiritual laws and impulses.

Before we pass on to the theory of light and colour, it may be well to refer briefly to a problem without the solution of which no thorough research into the living, or even the inanimate, will be possible—that is, the problem of space and time and its relationship to man.

Chapter VI

SPACE AND TIME: THEIR GENESIS AND THEIR CESSATION

SINCE we have to admit that the world we perceive consists of "states and their transitions one into another," and that furthermore these states and their transitions are brought about by the etheric formative forces, therefore we may now adopt as an established basic principle that the world we perceive has been created and is being created by these etheric formative forces. Since, however, " time " and " space " are only attributes of the phenomenal world, we may say also, therefore, that space and time first appeared, were created, began to exist, with the etheric formative forces and through their action!

Professor L. Graetz says in " Der Äther und die Relativitätstheorie " (p. 79) : " If we wish now to summarize our observations, we must say that, according to both the theory of ether and the theory of relativity, there exists in addition to matter in the general sense, including the electron, something else, which Wichert calls the basis of the world. The theory of ether gives to the world-basis characteristics which are not admissable in certain details, but which do not entirely divest it of every quality of substance. According to the theory of relativity, on the contrary, this world basis is something utterly devoid of the quality of substance, something, therefore, which we cannot describe but will designate, with Einstein, as the space-time continuum. It is futile to endeavour to form a sense-image of the space-time continuum. This can be done only with respect to sense-perceptible things. One has the same difficulty in coining words for this as Faust had in the case of the Mothers." (Faust, Part II., Act I. : Dark Gallery.)

Professor König expresses the opinion, in his book entitled " Die Materie," that the weak spot in all systems lies in their explanations of the coming into existence of the spatial world. To the metaphysician proof is needed as to how the non-spatial world became a spatial world. He inquires : " But how can this come about ? How can a being by its nature non-spatial take on a spatial form ? No entity can send forth from itself something which was not already within it," and so it would be impossible, he asserts, for the non-spatial, in which there is no juxtaposition, to be the inducing cause of the appearance of a spatial organization" (König, p. 75).

Here, however, I might ask the reciprocal question whether he who thus treats this view, to-day so widespread, has observed how from the seed of a carnation there comes forth a carnation plant. For in this process that which is called impossible, that a non-spatial "can be the inducing cause of the appearance of a spatial organization," may come under the direct observation of every man, and become, therefore, an item of his own experience.

What is here happening? We are forced to answer: A passing over of Being into the phenomenal world. We have already shown above that the genesis of the carnation out of the carnation seed is not to be ascribed to an external physical influence—for instance, the planting of the seed in the soil—for in that case all plants would necessarily be alike. We cannot say: "This external influence produces this result," but only: "To this definite influence responds the inner active principle in this manner. What happens is the result of an inner law." But neither can one say that within the physical seed the carnation exists in a diminutive form, and that the growing carnation is only the extension in space of what was already in spatial state within the seed. This preformation theory was long ago refuted by science as an absurdity both theoretically and practically, for no one will ever be able to find this in the seed by means of any physical research. One can on the contrary say that the active principle in the carnation seed, the idea of a carnation, the will to be a carnation, the being of the carnation, when it passes over (in the growing plant) into the phenomenal world, passes also from supersensible Being into the world of space and time. In the sense expressed above: "A non-spatial entity is the inducing cause of the appearance of a spatial organization." This is a set of facts which simply cannot be disputed because it belongs to the world of experience. The fundamental lesson we may learn from it, therefore, is this: The spatial comes into existence when the being of a thing passes over into the phenomenal world, for in truth we can perceive in the plant growing out of the carnation seed how that which is non-spatial—the idea of the carnation—passes over into that which is spatial, the phenomenon of the carnation. In this occurrence the substance taken from the earth is the least essential thing; the most essential is the coming into existence of the coloured form of the carnation, which alone makes this phenomenon a real carnation: that is, the most essential is the coming of a part of the phenomenal world out of "nothing"—that is, out of the spiritual.

Moreover, before everything else, we must dispute the assertion that questions of this sort—that is, how the transition of a non-spatial into the spatial occurs—belong solely to the sphere of metaphysics. In true research into Nature such an arbitrary distinction cannot be admitted, for the physicist, in the case of many phenomena which he considers it necessary to explain in a purely physical way, is simply forced to take under his scientific consideration such questions as the transition from the non-spatial to the spatial—that is, the question of the genesis of space. For instance, I refer the reader merely to the so-called " becoming latent " of heat, or the " release of latent heat " in the change of states of aggregation, etc., where we are dealing undoubtedly with such a transition from the spatial to the non-spatial and vice-versa. A similar fact might be pointed out in the becoming latent of mental presentations in the phenomenon of human memory.

Writing in opposition to the objectivizing of space by Newton " who classes his absolute space among the real entities," Einstein says : " Newton might as well have designated his absolute space by the term *ether*."* But such an ether would have been the product of human perplexity, a passive padding and not anything active and real. When, however, one sees that transition from non-spatial to spatial actually happens—and the perception of this process is to a certain extent possible to man—then the question always forces itself upon us whether there is a something, an active principle, which carries the one state over into the other, which causes, *mediates*, the transition from being into phenomenon, from non-spatial into spatial. This something consists of the etheric formative forces. *When they begin to work, then occurs the genesis of states of juxtaposition and of succession.*

We have seen that, both phylogenetically and ontogenetically, heat—that is, warmth ether—is the primal working entity. When this passes over from the state of rest into activity or, in other words, passes from the " latent " state imperceptible to our organs into the state of activity perceptible to us, it then actually enters into the world of space and time. Gradually there proceed from it the three additional etheric formative forces. While the three additional etheric formative forces, which weave the perceptible world of colour and form, proceed from the warmth ether, then really begins also for the first time through the action of these four etheric formative forces the space-time processes, which constitute our phenomenal and perceptible world.

The relation of the spiritual, the real, to the spatial, phenomenal, becomes clear to us in considering the relationship of human thinking to the space-time process. Dr. Rudolf Steiner says :* " Whoever asks himself what transition there is from one thing to another in which the thing itself remains a matter of indifference must answer unreservedly, space. Every other relationship must base itself upon the qualitative nature of that which exists as a separate thing in the world. Only space permits no other consideration except this : that the things are separated. When I read : *A* is above, *B* is below, it remains a matter of indifference to me what *A* and *B* are. I associate with them no other conception than that they are separate factors of the world I perceive through my senses. But, when our mind enters into the experience, this is what the mind wills to do : it wills to overcome the separateness and show that in each single thing the force of the whole is to be seen. Through the spatial perception it desires to overcome nothing else except the separateness, as such. It will set up here the most universal of all relationships. That *A* and *B* are not each a world for itself but belong to a common whole—this we learn from the spatial perception. This is the meaning of *juxtaposition.* Were each thing a being for itself, then there would be no such thing as juxtaposition. I could in that case not set up any relationship of beings with each other."

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* A. Einstein : " Äther und Relativitätstheorie," p. 11.

Thus the human spirit, human thought, seeks to re-unite into a unity that which in the perceptible world is sundered. In the sense intended above we may say that it reverses the action of the etheric formative forces which bring about the phenomenal world : it leads backwards from the phenomenal to real being, from the separate, the spatial, into the real, the non-spatial. When we shall have considered the etheric processes which take place within the human organism, then this will become clearer to us.

The same is true also of " time." In regard to this Steiner says :† " The concept of matter has arisen from a wholly erroneous concept of time. It is supposed that the world vanishes into a mere appearance void of real being if one does not think that beneath the mutable sum of events there lies an immutable, which persists in time, an immutable which abides while its attributes change. But time is not at all a vessel in which the mutations play themselves out ; time does not exist *prior* to things and *apart* from them. Time is the *expression given by our senses* to the circumstance that facts in their content are dependent one upon another in sequence. Suppose that we have to do with the perceptible fact-complex a_1, b_1, c_1, d_1, e_1. Upon this depends, from an inner necessity, the other fact complex, a_2, b_2, c_2, d_2, e_2 ; then I understand the content of the second when in idea I let it proceed from the former. Now suppose both complexes appear in the phenomenal world—

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* E.G.N.S. p. 223.

† p. 209.

for what we have been referring to has been their wholly non-spatial and non-temporal being. If, however, a_2, b_2, c_2, d_2, e_2, is to appear as a phenomenon, a_1, b_1, c_1, d_1, e_1 must likewise be a phenomenon, and in such manner that a_2, b_2, c_2, d_2, e_2 appears in its dependence upon a_1, b_1, c_1, d_1, e_1. That is, the phenomenon a_1, b_1, c_1, d_1, e_1 must appear, and must make way for a_2, b_2, c_2, d_2, e_2, which then appears. Here we see that time first arises when the being of a thing comes into the phenomenal world. Time belongs to the phenomenal world. It has nothing to do with the being itself. This being can be conceived only in idea. Only one who cannot completely carry through this reversal from appearance to being in his processes of thought—only he postulates time as something prior to events. But he then requires an actuality which outlasts the mutations. For this purpose he seizes upon the concept of indestructible matter. In so doing he has created for himself an entity with which time shall have nothing to do, something enduring amid all transmutations. In reality, however, he has only shown his inability to penetrate from the appearance of things in time to their real being, which has no relation to time. Can I say, then, of the being of a thing, that it either comes into existence or ceases to exist? I can say only that its content determines another and that this determining appears as a temporal sequence. The being of a thing cannot be destroyed; for it is wholly outside of time and determines time. We have hereby cast light upon two concepts, of which there is as yet but little understanding—that is, being and appearance. Whoever grasps the matter rightly in the way we have explained will not seek for evidence of the indestructibility of the being of a thing since destruction includes the concept of time which has nothing to do with being."

The same thing which we discovered with reference to space, and were enabled to see in the plant growing out of the seed, the genesis of the spatial coloured form out of something non-spatial—this is true also of the time-experience of man. *Space and time come to be when the being of a thing passes over into the phenomenal world;* or, to speak in the sense employed above, when the activity of the etheric begins in juxtaposition and in sequence. Before the beginning of the activity of the etheric in the phenomenal world in juxtaposition and sequence, to speak of space and time is to transfer to the realm of Being conformities to law drawn from the phenomenal world—therefore to be guilty of a contradiction. This becomes concretely clear when we reflect how man, as thinking and concept-forming "being," reverses the work of the etheric formative forces: he holds in concept before himself the things of the phenomenal world as spatial, indeed, and yet not "in space," else his head would have to be as large as the world he conceives.

The etheric formative forces are, as it were, the bridge between being and phenomena—but thereby at the same time the bridge also between non-spatial and spatial. For only when they begin to work does there originate a juxtaposition and a succession—that is, space and time. Therefore, Newton could not, as Einstein suggests, have named his space *ether*, but he might well have seen how space originates and ceases when etheric formative forces pass over from a state cf rest into activity or from activity into a state of rest.

If the etheric formative forces are active in juxtaposition and in succession, one can then distinguish in turn between the (phylogenetically and ontogenetically) earlier groups, warmth ether and light ether, which act expansively—that is, in a space-affirming way (Chap. II)—and the later, chemical ether and life ether, which act contractingly—that is, in a space-denying way.

The evolution of the world takes its course, therefore, not merely between primal nebula and heat-death but between space-genesis and space-annihilation, between the affirmation and the denial of space. First, then, in the phylogenesis of our cosmic system, there appeared the space-affirming; and later, on the other hand, the space-denying forces (Chap. II). The genesis of the etheric formative forces is the genesis of space.

If anyone is willing to pursue his research further in this direction, he can arrive at a concrete conception of the genesis and the disappearance of both time and space in the phenomenal world of the kingdoms of Nature. The "space-and-time problem" will then pass out of the sphere of abstract juggling, foreign to life, into which it has come in the decadent thought of post-Kantianism, and will enter the sphere of real and vital scientific research and knowledge. The metaphysicist and the physicist, instead of speaking quite in disregard one of the other, will again be able in their new form to grasp hands.

Chapter VII

FUNDAMENTAL PHENOMENA FOR A NEW THEORY OF LIGHT

GOETHE calls light a primal phenomenon because it belongs among the basic elements of the cosmic process which cannot be traced by the human understanding further back to causes accessible to our experience. If we observe this entity light more closely, we shall discover that it certainly does not consist only of "waves" or "vibrations," as this materialistic age would maintain. Professor L. Graetz in that work of his which so boldly opposes many fallacious conceptions hitherto held, "*Der Äther und die Relativitätstheorie,*" writes thus (p. 13): "The wave theory of light is confirmed by a vast number of the most striking and most minute phenomena, which are explained thereby in the simplest and most logical fashion; but there also appear in connection with light, as has gradually become evident, phenomena which cannot at first be reconciled with the wave theory. And every difficulty which opposes itself to the wave theory of ether must be thoroughly tested, for it may have to do with the ether itself, which we desire to investigate."

If light consisted merely of waves or vibrations, the earth and man would long ago have gone to ruin. Fortunately, the cosmos is more wisely guided than as a mere mechanical automaton. I do not say that with the action of light within the world of substance there do not appear, among other things, also wave motions. This is obviously always the case, only this quantitative aspect is, for an understanding of light, almost the least essential of the phenomena produced by that entity. In order to reach a more profound conception of the pre-requisites of existence of light in the world of substance, we shall first observe the reciprocal relationship of light and a primal element of substance, oxygen, and its variations (theory of light), in order that we may pass on to the reciprocal action between light and the manifold world of other substances and forces (theory of colour).

Through accurate observation of the reciprocal action of light, and the world of substance, I discovered the phenomenon that there are fundamentally two sorts of light phenomena which rest upon two entirely different causes, that is, come into existence in entirely dissimilar ways and subsist in utterly dissimilar reciprocal action with the world of substance. There are two phenomena of light in the world of substance polarically opposite to each other.

One kind, which we shall call " pure light " owes its existence to certain processes in which the absence of heat—that is, warmth ether—is the essential fact ; the other kind, which we shall call—in order to have a means of designating it—"heat-light," owes its existence and composition chiefly to the action of warmth ether. This second kind of light is only the accompanying phenomenon and result of the destruction of substance through the process of combustion. The unfailing fundamental mark of distinction between these two kinds of light in the earth organism is the following.

Pure-light phenomena always give rise to the threefold oxygen* (ozone) adjusted to the number three ; indeed, it is really bound up with the presence of ozone—that is, it cannot appear or manifest itself to human perception apart from ozone. Heat-light, on the contrary, or the light phenomenon dependent upon the co-operation of warmth ether, is always linked with the twofold oxygen, adjusted to the number two (O_2)—that is, it cannot appear or manifest itself to human perception apart from twofold oxygen. Unlike pure light, it cannot manifest itself in threefold oxygen, ozone. We shall now explain these facts in detail. The pre-requisite for the existence of " pure light " in the phenomenal world is threefold oxygen ; for heat-light twofold oxygen.

The Phenomena of Pure Light

These appear on the one hand in sunlight—that is, in the rays penetrating into the earth organism from without ; and on the other hand within the earth organism itself in the phenomena of phosphorescence and the like, as well as the phenomena of radio-active decay.

1. Cosmic " Pure Light."

Let us here follow briefly from this point of view what we have learned in the discussion of the ontogenetic genesis and disappearance of substance (Chap. IV).

The sun's rays of life ether, when they penetrate the outermost layers of the earth organism, form helium ; as they enter further and reach the sphere of light ether, there they form ozone, the threefold oxygen.

The formation of threefold oxygen, or ozone, as a transitional stage in the passage of the sun's rays toward the solid earth, is of the utmost importance for rendering sunlight (pure light) visible to the human eye. For ozone absorbs life ether with a greater intensity than does any other terrestrial substance—that is, it reduces the action of life ether to that intensity which is bearable to the eyes and other organs of man living upon the solid earth in an atmosphere of twofold oxygen.

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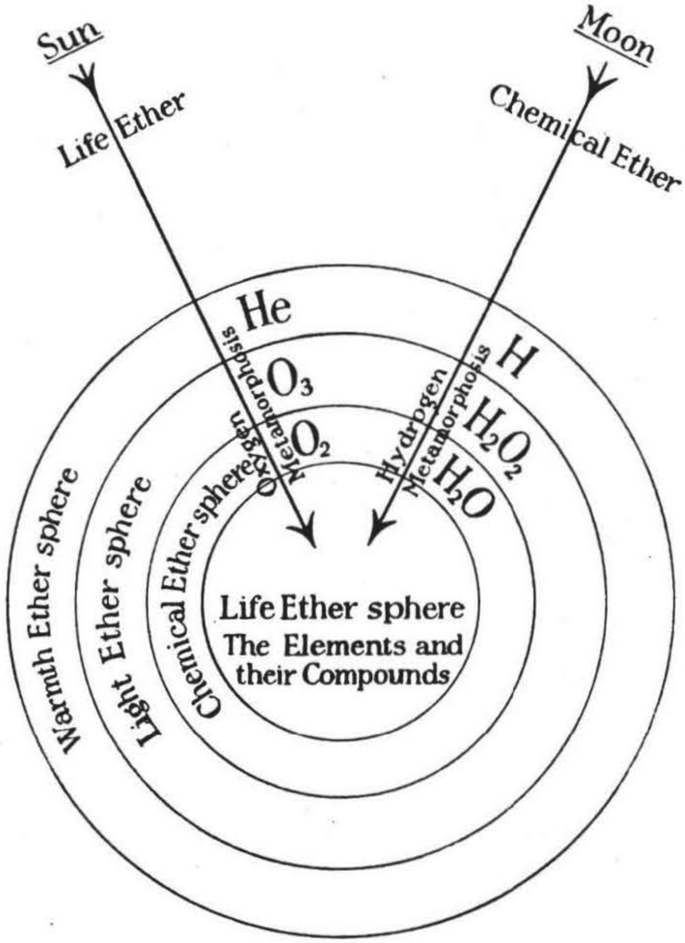
* See footnote, p. 108.


Sun
Life Ether
Moon
Chemical Ether
He
O_3
O_2
Oxygen Metamorphosis
H
H_2O_2
H_2O
Hydrogen Metamorphosis
Warmth Ether sphere
Light Ether sphere
Chemical Ether sphere
Life Ether sphere
The Elements and their Compounds

Pure, unmitigated life ether (sunlight) would destroy the human eye and the entire human body. Abundance of proof can be adduced of this mitigating action of ozone. Professor K. A. Hofmann says in his "Lehrbuch der anorganischen Chemie" (p. 80): "The absorption of ultra-violet light by ozone is so extremely intensive that a layer of ozone only 25 μ thick reduces the intensity of light by one-half. According to this the ozone absorbs with greater intensity than metals take up light in the visible spectrum." Here we shall add what will later be proven, that the sun's rays here referred to—that is, rays in the invisible part of the spectrum—are by no means explained by that very loose and vague term *ultra-violet*. But most essential is the fact that ozone, more than anything else in the world of substance, exercises an enormous absorptive action on the intensity of light. Ozone, in which life ether is thus always held in absorption, destroys the human skin, the flesh, and vegetable and other organic substances when it is brought in direct contact therewith from without and in large quantities.

Thus the physical human body can bear the free life ether of the sun's rays only in the diluted form which has passed through threefold oxygen (ozone) as this diluted life ether then appears as the phenomenon light in the twofold oxygen of the lower atmosphere.

In this fact we have one among the reasons why the light-ether sphere is thus designated, since it is in this sphere of the earth organism that the macrocosmic etheric forces streaming from without are reduced to such less powerful forces as convey the perception of the " light " phenomena to the human physical organs.

The earth organism is constituted with wonderful wisdom. By forming a layer of ozone in the outermost atmosphere, it protects man, who lives within the earth organism in the lower atmosphere, from the too intensive, destructive rays of the sun, and by means of this veil of ozone reduces the intensity of the sun's rays in such a way that man can perceive the reduced light which penetrates downwards. This is a fact of fundamental importance for all phenomena of life on the solid earth.

The man of to-day, then, if he were living in the upper light-ether sphere of the earth organism, would be an entirely differently constituted being, with quite different organs of perception and a correspondingly different state of consciousness. His organs of perception and his consciousness are now of such a character that, in his waking state, he can perceive light as it is brought to him in the lower strata of the earth organism, the state of this light being due to the fact that the earth organism, through the formation of ozone, prevents the streaming in of a different light which would be too powerful for his present organs of perception and would destroy him. Anyone who thinks these facts through to a conclusion will, by this means, gain a sense of perspective in the space-time process, the full explanation of which, at this point, would take us too far afield.

2. Terrestrial " Pure Light."

Besides coming from without as a cosmic in-streaming into the earth organism, pure light appears also within the organism of the earth itself, though, of course, to a very limited extent : that is, in the light phenomena of phosphorescence, and other essentially related phenomena. As we shall see, the genetic process of pure light in these instances shows the same causes, and is associated with the same essential related phenomena upon the solid earth as we have described in the case of the upper strata of the earth's atmosphere :—primarily, therefore, with the inevitable formation of threefold oxygen (ozone). Indeed, scientific research has established the fact that the formation of threefold oxygen is associated with all phenomena of phosphorescence, though unfortunately the proper emphasis has not yet been placed upon this fact, exceedingly important in its bearing upon terrestrial relations. The luminosity of phosphorus is due, among other things, to the formation of phosphorus trioxide. It is now a thoroughly established fact that, in the processes of oxidation of phosphorescent objects, the number of the oxygen content operative in this oxidation is uneven, and that ozone is always formed.

For the science of organisms, which must in the future occupy itself in the most thorough-going manner with ozone, emphasis must be placed upon the importance which phosphorus has for the organic world in that it not only occurs in the bones and teeth of men and animals, but is an important ingredient in the compounds of albumen (lecithin) and exerts great influence particularly upon the human liver (see Chap. XII). In his remarkably comprehensive " Lehrbuch der anorganischen Chemie," Professor K. A. Hofmann says, moreover : " The higher plants also require phosphoric acid for the building up of their albumen, especially in the seed." Research into organisms will now gain glimpses of many profound truths if it directs its look, not only to phosphorus as a substance, but much more to that action of forces in phosphorus, which are manifested, not only in the formation of ozone but also in the genesis of pure light. For in this lies the vital truth that for the science of organisms, phosphorus is of decisive importance, not merely as a substance but chiefly through its radiation of force, as this has been systematically explained in connection with the laws of the earth organism.

A phenomenon of the utmost interest and profound import lies in the fact that the light phenomena of phosphorus cease when it is prevented from creating the conditions corresponding to the processes in the upper light-ether sphere of the earth mentioned above. If, for instance, one renders impossible the formation of ozone, etc., from shining phosphorus, by surrounding it with oxygen which is under the normal pressure of our lowest atmospheric stratum, 760 mm, the phenomena of light will cease. This is certainly the most impressive evidence of the fact that in phosphorus appears the action of the same forces which give rise to cosmic pure light in the higher light-ether sphere of the earth organism. For its activity in creating light ceases when one arbitrarily subjects phosphorus to the laws of the lowest atmospheric strata.

The discovery by the Swiss Dr. Th. Gassmann that rainwater and snow streaming down from the clouds contain phosphoric substances* affords a new confirmation of what has been said above in regard to the light-ether sphere. Only we would express this differently, saying that in the realm of cloud-formation (upper light-ether sphere of the earth organism) there are active the same etheric forces which manifest their activities below on the earth in phosphorus. Here also the observation of the action of forces would prove richer in results than the observation of the substance phosphorus.

Ancient wisdom schools of the Orient and the Occident spoke of Lucifer-" Phosphorus " who brought the heavenly light down to the earth and gave it to man in a debased form.

Phosphorus is so fundamental an element of the organic, the living, that its most important qualities can only be mentioned here, and must await a separate future discussion. We must, however, refer at this point to a phenomenon of phosphorus which stands outside the general laws of the earth, and absolutely contradicts our hitherto systematized conceptions of " combustion " : that is, the *flame of phosphorus is cold*. We are face to face in this with a unique phenomenon of profound significance, the full interpretation of which is impossible in our day. The flame of phosphorus is so cool that a man can comfortably hold his hand in it. Professor Hofmann says (loc. cit., p. 228) : " This shining without perceptible burning caused a sensation from the first discovery of phosphorus by von Brandt (1669). The shining ' magic pellets ' were carried as curiosities to the courts of the contemporary princes and brought astonishingly high prices. . . ." And elsewhere he adds : " Doubtless the light-energy is here derived from chemical energy which is freed through the gradual process of oxidation but does not pass over into heat and therefrom finally and indirectly into radiant energy, as usually happens, but expresses itself in part directly in visible rays of light."

We shall formulate this somewhat differently according to the theory of ether as already stated : *The phosphorus shows all the characteristics of " pure light "* :

1. It forms ozone.
2. It requires the laws which are characteristic also for cosmic pure light of the upper atmosphere (luminosity ceases at a pressure of 760 mm, since the laws of the upper light-ether sphere are striven for).

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* Dr. Th. Gassmann : " Meine Ergebnisse über die Entdeckung der gleichen Phosphor enthaltenden Substanzen im Regen-, Schnee- und Eiswasser und im Menschen-, Tier- und Pflanzenorganismus." Bern, 1921. (" My experiments leading to the discovery of the same phosphoric substances in rain, snow and ice as in the human, animal, and plant organisms.")

3. Its light is generated without the co-operation of warmth ether. Its flame is cold.

All the requirements set up for " pure light " are thus fulfilled.

This cold flame has been named after its recent discoverer the " Smithell flame." For the sake of historic truth, however, it should be remarked that this cold flame, in contrast with hot flame, was mentioned in the most primitive religious texts, where indeed, if we read rightly, we learn more about all these matters than through the mention of them in modern text books which generally limit themselves to the comment " noteworthy " or " striking " and at once pass on to the order of the day. We shall discuss more thoroughly the polarity of cold flame and hot flame within the earth organism in connection with the consideration of the organism of man (Chap. XII). It is a primal phenomenon in cosmos, earth and man. If I refer here to the inter-relationship of such manifestations with the view of ether as here set forth, the reader will please bear in mind that I do not conceive of the etheric formative forces as merely automatic mechanisms, as would be the case under the ether theory of physics, but that I conceive them as bound up with a whole array of qualitative and spiritual attributes and causes.

In connection with phosphorus a mass of material may be observed helpful for an understanding of the action of the etheric formative forces, though at this point we can refer to only certain of the most essential details. It may be well, however, to point out the relationships of the other more decadent modifications of phosphorus, the red and dark-red phosphorus.

Just as, in the process of oxidation under the pressure of the lower atmosphere (760 mm) and in the artificially produced condition permitting the presence of only twofold oxygen, colourless phosphorus ceases to be luminous, because the independent formation of ozone by the phosphorus is then impossible, the other modifications of phosphorus—the bright red and the dark red—do not shine at all except when ozone is artificially conveyed to them. For since they do not contain by absorption the life ether which is essential to the formation of threefold oxygen, in such quantities as the colourless phosphorus, they are not able independently to produce any threefold oxygen and they can therefore become independently luminous only when we provide them with ozone and thus with the absorbed life ether contained in this. Then, however, the bright-red phosphorus becomes extremely luminous and the dark-red, which already contains warmth ether, only slightly so. In contrast with the colourless phosphorus—not containing any warmth ether and which independently forms ozone and gives off pure light—the red phosphorus, which because of the warmth ether it contains can no longer do this independently, is thus already a decadent product acting under predominantly terrestrial laws.

Finally, we must point out that the light which glow-worms emit is identical in its spectrum with that of phosphorus. Here, then, similar processes and phenomena proceed from a living creature.

The appearance of pure light in the process of destruction of substance known as radio-activity we shall be able to observe and to classify in Chapter X.

" Heat Light "

(That is, light phenomena which depend upon the terrestrial process of combustion, or the co-operation of warmth ether.)

While the phenomena of pure light, which depend upon the action of life ether and light ether and in whose genesis warmth ether does not co-operate, are still in a very general way free from arbitrary human control at both poles of its manifestation, as sunlight streaming into the world and also within the earth organism in connection with radio-activity, phosphorescence and the like, the other light phenomena (heat-light) which depend for their manifestation upon the co-operation of warmth ether, are completely subject to arbitrary human control.

The laws governing the origin, continuance and manifestation of the light phenomena connected with warmth ether are polarically opposite to those of pure light.

This may be illustrated by means of an especially striking example. A unique and well established phenomenon in experimental chemistry is the fact that a burning candle, when placed in a closed air space, ceases to burn at the moment when the volume of oxygen in the closed space is reduced from about 20·6 per cent. to 14 per cent. Modern text-books in chemistry generally pass over this phenomenon, which is of fundamental importance for many relationships within the earth organism, with the comment that the oxygen is apparently only partly used up by burning bodies. But the minimal consumption of oxygen for oxidation—a consumption inexplicably small in comparison with the facts elsewhere—is the least essential part of this phenomenon. The burning candle goes out, when the volume of oxygen surrounding it has diminished from 3 × 7 to 2 × 7 (about 20·6 : 14), not only therefore because it uses the oxygen only partially, but for the following reasons which lie at the basis of what we have been saying. Let us recall that the volume of a given quantity of threefold oxygen, when changed to twofold oxygen, expands in the proportion of 2 : 3, or in the inverse ratio, and vice versa. This makes it clear that what we are here dealing with must be explained as follows : The candle burning in a closed air space ceases to burn and to shine at that moment when the oxygen has diminished to the volume it would show if it became ozone—that is, when the laws and force-relationships in the air-oxygen surrounding it which are characteristic for twofold oxygen pass over into those typical for threefold oxygen. The candle therefore burns and shines only so long as the force-structure of its life-element, twofold oxygen, is dominant, and it goes out, dies, in that moment when the laws begin to operate in its environment which are the essential pre-requisite life element for its polar opposite, " pure light."

In this phenomenon we are face to face with one of the most significant phenomena in cosmos, earth, and man.

One can here look into the workshop of earthly Promethean fire and see its opposition to pure cosmic light.

This process of metamorphosis in the air surrounding the candle is naturally highly unstable. Ozone exists, as it were, only in a nascent state. We shall call attention to the same unstable process of metamorphosis of oxygen in human blood. The metamorphosis in the case of the candle occurs in such a way that usually, after the extinguishing of the candle, the general laws of the environment again instantly cause the reverse metamorphosis into the force-relationships of two-part oxygen. We are dealing here, as it were, with a continual conflict between forces which tend to form twofold oxygen and others which would form threefold. So long as the former forces are victorious, the flame burns ; but, when the second forces conquer, the flame goes out, it dies ; whereupon the former forces again conquer and form the twofold oxygen, which corresponds with the laws of the lowest atmosphere. This polarity of the action of forces which manifest themselves here in the earth organism in the burning and the dying of a flame, we shall find again in the organism of man.

Professor K. A. Hofmann refers to the unusually early dying out of the flame in a closed space, and points out the following important face (loc. cit., p. 321) : " If, for example, a wax candle burns in an enclosed space of air until it spontaneously goes out, the gas . . . shows almost the same composition as that exhaled by man " (F. C. G. Müller). The theory of ether now enables us to understand how man, by means of his etheric forces, carries out within himself, in his blood currents and in his breathing, the processes of combustion and of that peculiarly labile transformation of oxgyen. (See Chap. XII, p. 220.) In man also there is active something of the nature of the flame coming into existence under certain conditions and then dying out, something of the polarity of " heat-light " and " pure light." Man bears within himself the secret being of the " flame " of fire, of which the myth of Prometheus speaks.

From these phenomena we may learn the following fundamental truths :

1. Luminous combustion (heat-light) is not due at all, as has hitherto been assumed, to the presence of atmospheric oxygen, no matter of what sort, but is connected with the laws governing twofold oxygen. If we compare this result with many processes within the earth organism which we have already described we shall arrive at possibilities of understanding of the most comprehensive character.

2. Moreover, it now becomes easy to clarify the question : What has led on the one hand to the formation of threefold oxygen in the closed air-space and on the other hand to the extinguishing of the light of the candle ? Both the results are due to the action of the life ether, and this is enabled to work because in the process of burning, solid substance is destroyed. Let us recall that the solid state of aggregation of matter is due to life ether (Chap. II), and it becomes clear that the life ether is freed through the destruction of solid substance in the process of burning, and ether can become active as free life ether in the formation of ozone and radiation of light, as indeed we have actually shown. But this luminosity which depends upon the breaking down of substance through combustion is, however, dependent upon the co-operation of the warmth ether which causes the destructive combustion. In the moment when the life ether, through its tendency to create the condition necessary for threefold oxygen, has brought about the laws which are essential to its life, but in which the polarically opposite warmth ether cannot live, then the combustion caused by the warmth ether ceases, and therewith ceases the breaking down of substance, and in turn the liberation of life ether together with the accompanying phenomenon of light—the candle goes out. *Light is thus chained to heat in the case of " heat-light," but not in the case of " pure light."*

The fact that, in the process of combustion accompanied by light, the co-operation of life ether is also essential for the appearance of the phenomenon of luminosity—is shown by the fact that gases (that is, substances which are not found in the life-ether state : Chap. II) cannot of themselves produce a luminous flame, whereas on the other hand the solid bodies (that is, substances which belong in the life-ether state) send out rays of light when glowing hot. It is therefore obvious that the life ether freed through the destruction of solid substances is necessary to enable the combustion process to become luminous. Only, the action of the light phenomenon is here dependent upon the co-operation of the warmth ether from first to last, as we have seen, through the conflict over oxygen, for which reason this kind of light is called heat-light.

This new classification of manifestations of light within the earth organism as pure light and heat light has thus demonstrated its correctness by reference to phenomena ; likewise have the marks of their distinction—difference in relationship to one primal substance—for pure light requires threefold oxygen where heat light requires twofold.

Pure light dies under the laws required for heat light.

Heat light dies under the laws required for pure light.

Pure light is radiated down out of the cosmos into the earth by the sun ; within the earth organism it is given off by phosphorus and by substances which are in process of breaking up (radio-activity).

Pure light shines as a cold flame. Its action is free from heat.

Heat light accompanies terrestrial phenomena of combustion. The manifestation of light is here not free, but is chained to heat.

Pure light and heat light—that is, the light which is chained to heat—constitute an extremely important polarity lying at the foundation of many mysteries within the earth organism which are not yet unveiled. We shall again find these polarities between forces most of all in man and his organism.

Chapter VIII

FOUNDATION FOR A NEW THEORY OF COLOUR

IT would not be possible to speak here on the basis of reality concerning the true nature of phenomena of colour had not Goethe in his theory of colour given the foundation for a conception of " light," " darkness," and " colour " which can be set over against the terrible caricature that has been systematically developed from the mechanizing hypothesis of Newton in the course of the present materialistic age. In his remarkable work on " Goethe's Conception of the World," which will in future serve as the point of departure for many researches in the world of organisms, Dr. Steiner said in regard to the mechanistic theory of light and colour: " Newton was the founder of this view which Goethe found prevailing among natural scientists and which indeed still occupies the same position to-day. According to this view white light, as it proceeds from the sun, is composed of colours. The colours arise because the constituent parts are separated out from the white light" (p. 141).* Steiner then describes how Goethe, by means of unprejudiced observation of actuality, discovered the errors in this view and proved these by experiment. " After these experiments, Goethe cannot adopt the Newtonian conception. His attitude to it was the same as his attitude to Haller's preformation theory. Just as according to this theory the developed organism with all its parts is contained in the germ, so the Newtonians believe that the colours which appear under certain conditions in the light, are already contained in it. Goethe could use the same words against this belief which he used against the preformation theory: that 'it is based on a mere invention, devoid of all element of sense experience, on an assumption which can never be demonstrated in the sense world.' To Goethe colours are new formations which are developed in the light, not entities that have merely developed out of the light."†

In reality the Newtonian theory of the enfolding and unfolding of the colours into and out of the white light is as fundamental an error as the senseless theory of Haller that the organism later developed is already contained within the seed. Science has rejected the latter theory as nonsensical, but has not arrived at the same deduction in the case of light. Goethe, to whose lot it fell to expose the abstract construction of Newton's hypothesis, and instead of this to base his own theory of colour upon the concrete processes of visible reality in the phenomena of colour, proceeded from the elementary manifestation which, on the one side, reaches the eye when it "*looks at a 'dark' through a 'bright' and perceives blue*"—as for instance it makes the dark cosmic space into the blue of the sky when seen through the illuminated terrestrial atmosphere.

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* Subsequent references to " Goethe's Conception of the World " (London, 1928) will be indicated as G.C.W.

† G.C.W., p. 146.

Goethe confirmed, furthermore, this mode of genesis for blue by placing before one another darker and whiter strips of paper, and by other experiments. On the other hand, he was able to prove that, in the reverse way, "*a 'bright' seen through a 'dark' gives yellow.*" The shining yellow sun seen through the darker layers of atmosphere confirms this; but this also Goethe proved by alternately interposing darker and lighter strips of paper and by other experiments. He also pointed out that blue and yellow occur as marginal phenomena wherever in Nature a 'dark' and a 'bright' meet together, a reality which any man can confirm by his own observation.

In order to reach a true understanding of the reality in the genesis of colour Goethe proceeded in forming his concept of the entity "darkness" not from any convenient customary mode of thinking and abstract hypotheses but from actual matters of fact accessible to experience. Steiner says of this: "Light presents itself to observation as 'the simplest, the most homogeneous, undivided entity that we know.' Opposed to it, there is darkness. For Goethe darkness is not the complete, passive absence of light. It is something active. It opposes itself to light and interplays with it. Modern natural science regards darkness as a complete nullity. The light which streams into a dark space has, according to this modern view, no opposition from the darkness to overcome. Goethe imagines that light and darkness are related to each other like the north and south poles of a magnet. Darkness can weaken the light in its power of action. Vice versa, light can limit the energy of darkness. Colour arises in both cases! A physical view which conceives darkness as perfect passivity cannot speak of such an interworking. It has therefore to derive colours out of light alone. Darkness appears as a phenomenon of observation in the same sense as light. Darkness is a content of perception in the same sense as light. The one is merely the antithesis of the other. The eye which looks out into the night mediates the real perception of darkness. If darkness were the absolute void, there would be no perception on looking out into the dark."*

Goethe now advanced further in his observations and his inferences in that he tested the reciprocal relation between "light," "darkness," and the "world of substance"; and we shall see how adequately he dealt with the matter. Dr. Steiner says: "Empty space has the characteristic of transparence. It produces no effect upon light and darkness. These shine through it in their full activity. It is different when the space is filled with things. This fullness can be such that the eye does not perceive it, because light and darkness in their primal form shine through it. One then speaks of transparent things. If light and darkness do not shine unweakened through a thing, then it is said to be dull. Space filled with what is dull offers the possibility of observing light and darkness, bright and dark, in the opposite relationships. A bright thing seen through a dark appears yellow; a dark appears blue. The dull is a something which is brightened through by light. Against a brighter, more vivid light placed behind it, the dull appears dark; against a darkness shining through, it appears bright. Thus, when a dull thing stands against the light or the darkness, a present bright and a likewise present dark work into one another. If the dullness of the thing through which the light shines is gradually increased, the yellow becomes yellowish red and then ruby-red. If the dullness is diminished through which the darkness penetrates then the blue becomes indigo and finally violet. Yellow and blue are basic colours. They arise from the reciprocal action of brightness or darkness respectively with that which is dull."†

Let us now bring to an understanding of this what we have hitherto learned of the cosmic forces streaming into the earth organism. Before these applications are made, however, let us note an extremely important cosmic phenomenon which until now could not have been rightly explained but which in this connection admits of a consistent interpretation. In his interesting book already so often cited, "Erdmagnetismus, Erdstrom und Polarlicht," Professor A. Nippoldt says (p. 95): "The influence of the solar eclipse has been investigated in many ways. It is always discovered that, when diurnal variation has been eliminated, there has been the same behaviour of the elements, so that the darkening of the sun seems always to have produced the same effects. As a matter of fact, in the case of an eclipse, always with the dark shadow of the moon a whirling current passes over the earth having the same characteristics as the ordinary *night* currents. . . ." In this important phenomenon we learn to know one of the most important cosmic events, which demonstrates to us better than many others two fundamental truths:

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* G.C.W., p. 160. † ibid, p. 164.

1. Darkness is something active as it comes to expression, among other ways, in the whirling current which accompanies the shadow of the moon over the earth and which is like the normal nocturnal current.

2. This force of darkness, which works usually only during the night, but which becomes active also in like manner in the day during a solar eclipse, is in this case connected with the moon. When the moon hides the sun, as happens regularly in the case of the eclipse, the moon then exercises upon the earth the same specific action which is regularly exercised at night. (In regard to the influence of the moon upon the structure of the earth, etc., see Chap. III.)

We are dealing, therefore, not with a mere "absence of the sun's influence," a negative, but with an active, effective exercise of force during the phenomena of darkness, and this active force is in this case connected with the orbit of the moon. Goethe was also entirely right when he compared the action of darkness and the opposite action of light to the two poles of a magnet. Just as the human eye is impressed by real darkness, only in a polarically opposite manner from the effect of light, thus also the earth organism, as we have already thoroughly established in connection with other phenomena, is influenced by the action of two cosmic forces polarically unlike. Already in discussing the horizontal and vertical currents, in their reciprocal relationships with the phenomena of life and states of consciousness in the realm of Nature, we have seen the moon and the sun in their polaric contrast. There are thus two forces which stream to us out of the cosmos and act conjointly in unlike ways in the constitution of the structure of the earth organism and in its phenomena of life and processes of death: the life ether of the sun and the chemical ether of the moon.

Through the action of the etheric formative forces in the earth organism, arise the different variations in the world of colour, in the following fashion:—

When there is predominantly active in the illuminated world of substance of the earth organism

Warmth ether, then appears the colour red;
Light ether, then appears the colour yellow;
Chemical ether, then appears the colour blue;
Life ether, then appears the colour violet.

Therefore the sea, for example, whose watery element is dominated chiefly by chemical ether (Chap. II), appears to us blue, whereas a shining flame, which is controlled chiefly by warmth ether, appears red.

When yellow, in which the light pole of the spectrum preponderates, comes together with the blue, in which the dark pole preponderates, then appears the colour green.

The indefinite number of variations of the world of colour arise from the fact that either the light forces are gradually being suppressed by the dark forces, or the dark by the light. (See diagram, p. 141.)

When the forces of darkness weaken the light forces manifested in yellow, then appears orange, etc.

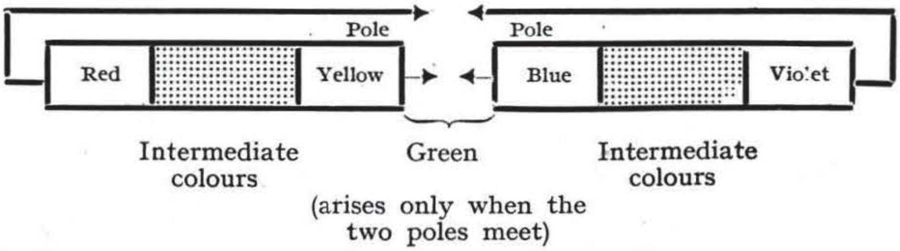
Every colour is the result of a conflict between the real etheric forces of light and darkness.

The reciprocal influence upon the plant world of these forces which come to expression in the colours will in future become one of the chief spheres of research in organisms. (For details, see Chap. XI.) Here we must only point out that plant cells, for instance, when subjected to the action of the rays of the yellow-red pole (light ether and warmth ether, expansive, see Chap. II) continue to extend and do not divide as much as usual, whereas plant cells which are exposed to the blue pole (chemical ether, concentrating, splitting) do not extend as much as usual but continually divide in a disuniting process.

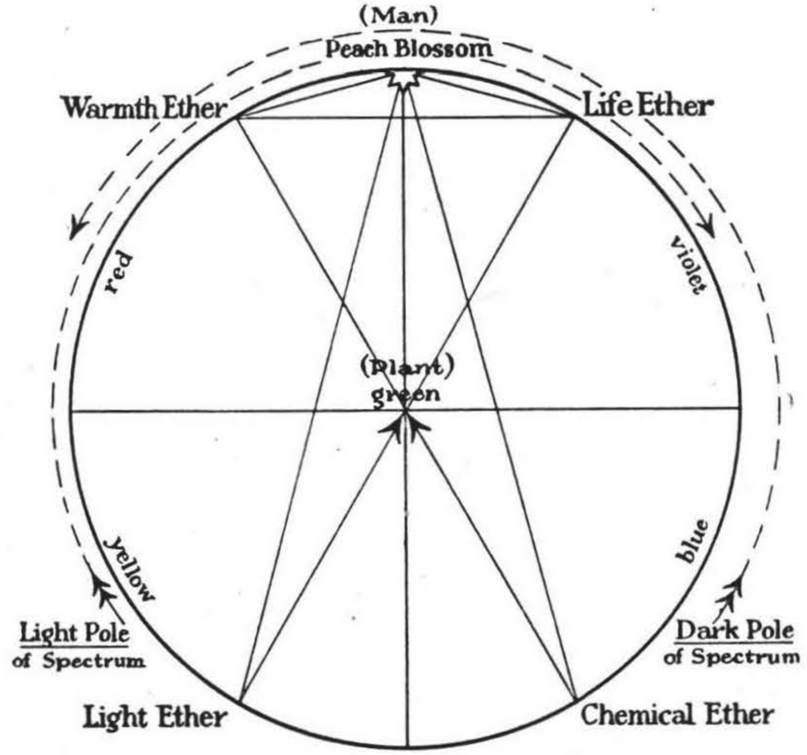
From the qualities of the etheric formative forces as described, we discover quite systematically why living plants will answer to the presence of a certain colour by an expansive or growing process (warmth ether and light ether), while the presence of a polarically opposed colour will be accompanied by a disuniting or cell-separating process (chemical ether and life ether). The colours and the evolutionary process are both the work of certain etheric formative forces with clearly definable qualities and tendencies in their effects. Herein lie the basic truths for a future research into genesis and disappearance, procreation and individualization, in the world of organisms.

We must recall that with the closing of the circle of the spectrum a new colour arises: "peach blossom," the colour of man incarnate, the living human body. In reality the so-called "peach blossom" colour is the colour of the living man, as a result of the harmonious working together of all the etheric formative forces, the summing up of the spectrum of Nature.

The spectrum of the world of colour in a band appears thus:



The closed circle of the spectrum of the world of colour gives us this picture, full of infinite wisdom and harmony:


(Man)
Peach Blossom
Warmth Ether
Life Ether
red
violet
(Plant)
green
yellow
blue
Light Pole
of Spectrum
Dark Pole
of Spectrum
Light Ether
Chemical Ether

The circle encloses: in its left half the expansive, space-creating, space-affirming forces; in its right half the suctional, concentrating, disuniting, space-diminishing, space-denying forces.

The circle encloses: standing opposite to each other, those forces which in the world of substance require the oxygen adjusted to the number three, which produce "pure light,"
Life ether and light ether,
as well as the force which in the world of substance requires the oxygen adjusted to the number two, which produces "heat light,"
Heat and cold,
Warmth ether and chemical ether.

The circle encloses: in its lower half the forces of the polarity of light and darkness;
in its upper half the forces of heat and life.

The circle encloses : in its right half the cosmic forces of sun and moon ;
in its left half the two further forces which are active in the earth organism ;
at the top, the union of all forces and colours, their harmony,
the colour of living man.

The circle encloses : all colours and forces in the spectrum of light and of Nature.

The circle of the spectrum of Nature and of light encloses two worlds. The world of spiritual Being streams into the world of substance, bringing to pass involution, evolution, "creating out of nothing," in an eternal harmonious circuit. Thus stream in also the cosmic formative forces into the living world of being of the earth organism, into the world of the "dull," the illuminated substance—bringing forth, through the manifold reciprocal action of the etheric formative forces, the variations of the world of colours in the world of extension, of space and of time.

Cosmic light and terrestrial light illumine the world of substance according to inner laws and harmonies, which with the colours and the forces of the closed circle of the spectrum of Nature and of light build the upward directed pentagram in the circle at the top of which stands that colour which distinguishes man alone in the world of phenomena.

The Newtonian preformation theory of light and colour is the image of a mechanistic, unreal, dead Nature void of the spiritual.

The reciprocal play between the "action of light" and that of "darkness" and the "illuminated world of substance" which, through the struggle of the formative forces in the world of substance, gives colour to the forms of this world, reaching the apex of their combined harmonized activity in living man, is the image of an organic real, living Nature, guided by Spirit.

The quantitative-mechanistic research into the world has brought us to a conception of the cosmic system as a corpse in which, nevertheless, we are alive. This is the conception of something unreal. If we pass on to form a conception of the living cosmic system in which we also live, we shall begin to fashion for ourselves an image of the reality.

Chapter IX

THE PHENOMENON OF TONE

WE shall not here enter into the question of the experience of tone or the theory of harmony in the realm of tone, since these things require a separate discussion. Those who have originated the greater philosophic conceptions—such as Kepler—understood, to be sure, how to bring the " harmony of the spheres " (harmonices mundi) in the cosmic system into inner and outer relation with the harmonies of the realm of tone accessible to human experience, a capacity for conceiving vast inter-relationships such as has been lost by our abstract intellectual culture. But along with this we have also lost the real understanding of certain organically related inter-dependencies of cosmic and terrestrial processes which may be of great importance also in relation to measure, number, and weight. While therefore the *harmonices mundi* must await separate discussion, we must here first observe the genesis of the terrestrial phenomenon of tone in connection with the activity of the etheric formative forces.

In our initial discussion of the formative forces (Chap. II), we applied to chemical ether also the term " sound ether," and elaborated this in the following manner : " Chemical ether is active not merely in its own manner in the differentiation, the division, and the uniting of substances ; but it is the forces of chemical ether also—though, as it were, in an activity in a different sphere—which transmit the tone perceptible to the senses. The inner contact of the two realms becomes clear to us in the case of " Chladni's figures." There it is tone that causes the weaving together, the arranging and shaping of substances and substance-forms. What audible tone effects then in the sand is happening everywhere in space. Space is interpenetrated by the forces of chemical ether which, after the manner of the Chladni sand figures, differentiate, separate and unite substance. Chemical ether has in reality also a tonal sounding nature, of which the audible sound heard by the physical ear is only an external expression—that is, an expression which has passed through the air."

The priest-scholars of the Egyptian mysteries who, without our modern instruments and without the accumulated information of our astro-physics, represented in the pyramids, among other things, the macrocosmic numerical relationships of the most remote stellar worlds, with an accuracy which our Egyptologists can only wonder at and cannot explain—these priest-scholars understood also this relation of the structure of substance to tone, a knowledge which is, unfortunately, quite lost to our age. The traditions of the Egyptians indicate to us in many ways, each independent of the other, that the two colossal statues of Memnon in the valley of the Nile gave forth every morning a tone at sunrise and greeted thus, as it were, the rise of the heavenly body. I. H. Breasted says in his well-known "History of Egypt"* (p. 384): "Only the two weather-beaten colossi (Statues of King Amenhotep III. [Memnon] which kept guard over the entrance of the temple dedicated to the moon god at Thebes.—G.W.) still look out across the plain; one of them still bearing the scribblings in Greek of curious tourists in the time of the Roman Empire who came to hear the marvellous voice which issued from it every morning at sunrise." From other sources we derive the same information. What we of to-day can produce only on a small scale and in the reverse order in Chladni's figures, but cannot at all explain—the adaptation of certain forms of matter to certain tones—this phenomenon the Egyptian priest-scholars knew how to call forth and to control on a huge scale and in either direction.† Since they knew thoroughly the relationship between certain tones and certain forms of substance, they were able to give to these colossal figures, as high as a cathedral, such form and inner structure that the active force of the rising sun caused this form to send forth the tone to which it was adapted. As we have said, we are able merely to wonder at the reverse process on a diminutive scale in Chladni's figures. A modern architect admitted in conversation with the author that we, unfortunately, cannot carry through structures in the reverse sense and especially on such a huge scale. When I saw the two mighty Egyptian colossal statues in the southern valley of the Nile, it became clear to me that they must have lost the capacity of producing tone out of their form for this reason, among others, that they have been so weathered down by the milleniums as to have almost wholly lost their original form.

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* New York, 1909.

† In Die Drei, February, 1926 (Vol. V., No. 11), the well-known Orientalist, Dr. H. Beckh, has brought out the most interesting fact in reference to the representation here given regarding the form-tendencies of the individual formative forces: that is, that the forms here used for chemical ether and life ether (the half-moon and the square) were employed in Egyptian hieroglyphics for the name of the goddess "Isis," whereas in the Peruvian texts the forms here assigned to warmth ether and light ether (the circle and the triangle) were employed for the name of the corresponding goddess. The American mystery places, historically related to earlier cultural centres, are thus seen to have used as symbols for the creative principle the forms of the formative forces phylogenetically earlier, while the Egyptian places, belonging later, used the forms of those forces phylogenetically later. We wish to express our heartfelt thanks to Dr. Beckh for this remarkable reference. This whole complex question opens wonderful perspectives for future research. See also Dr. H. Beckh: "Ätherische Bildekräfte und Hieroglyphen," in Gäa Sophia, Vol. I., 1926. In the second volume we shall recur to this subject.

Let us now consider more carefully this relation of tone to substance. We have shown the " spectrum of Nature " in the following manner :

Life ether,
Chemical ether,
Light ether,
Heat—Warmth ether,
Gaseous—Light ether,
Fluid—Chemical ether,
Solid—Life ether.

Chemical ether in the world of substance is thus adjusted to the fluid state of aggregation, and we have followed its action in the genesis of water, in the formation of clouds, and in the grand rhythms of the aqueous parts of the earth organisms. Naturally chemical, or sound, ether works, not only in the fluid state to which it is adapted, but also in the spheres of the other states of substance. Let us follow it in its activity in the sphere belonging above it, according to the description previously given, the gaseous state—that is, the surrounding air, the atmosphere. The gaseous state is produced by light ether, an expansive force. It represents a rarefaction of substance. Chemical ether, on the contrary, is a suctional force, drawing inward ; it tends to produce a condensation of substance. What takes place when the chemical ether, or sound ether, becomes active in the light-ether sphere of the air ? A conflict ! The light ether strives for a rarefaction of substance ; the chemical ether for a condensation. This constant back and forth swing of substance, of the air, between rarefaction and condensation, at a certain point passes over naturally to its environment and sets this into rhythmic wave motion which must also be shared by the tympanum of the human ear. At this point the action of the sound ether becomes manifest to human experience. But in this connection we must not fall into the error of supposing the audible tone phenomenon originates in the human ear or in some indefinite part of the brain. The tone phenomenon arises as an entity at the moment and at the point at which the conflict begins between chemical ether and light ether over substance, for its rarefaction or condensation.

This brings us also to an understanding of the fact, hitherto not entirely intelligible, that, when sound is produced in a vacuum—that is, in space void of air—it is not propagated. It would be more accurate to say that physically audible tone arises only when a conflict is possible between sound ether and light ether, over the rarefaction and the condensation of substance. In space void of air in which there is, of course, no substance whatever, there cannot take place, naturally, any conflict in regard to substance or any audible phenomenon of tone. The assertion that tone produced in a vacuum cannot propagate itself is, therefore, an erroneous statement of the case; for an audible tone phenomenon, as a matter of course, cannot occur in a vacuum and it is for that reason that it cannot propagate itself. That it is really the chemical ether, or sound ether, which produces the phenomenon of tone in the manner explained above, when it works in the world of substance, and that it is not any other ether, everyone can experience for himself who will sing a song in a very damp space—for example, in a bath room—and then repeat the same song in a space containing dry air. The action of sound in damp space is always very much stronger because the chemical ether, or sound ether, which is adapted to the aqueous state of matter (Chap. II) exists in the fullest measure in a damp space. The fact, moreover, that sound propagates itself most effectively in water—that is, in the fluid element—has been thoroughly established through experiment. It is also characteristic that sound has been proven to propagate itself more easily from a dense medium to a rarer medium than in the reverse order, for the reason that chemical ether, or sound ether—being adapted to a denser structure of substance—calls forth the sound by working in the rarer substance and seeking to transfer its own principles to that substance. Naturally, we are here dealing with extraordinarily delicate differentiations in processes.

It is also significant that the propagation of sound is intensified under increased pressure—that is, when the establishment of those principles for which the sound ether always strives (contraction, Chap. II) is artificially facilitated. The inter-relationship between chemical ether, or sound ether, and the action of pressure we have already pointed out in connection with the phenomena of barometric pressure within the earth organism.

Very characteristic, finally, is the fact also that the intensity of sound is much greater at night than in the daytime; that noises are heard much more distinctly at night than during the day. This, which reminds us of the evidence that the darkness as a concrete manifestation of an active force—and at the opposite pole to the activity of light (see The Theory of Colour, Chap. VIII)—is to be ascribed to chemical ether, as we were able to establish in the case of nocturnal currents generated by the action of the moon, and the phenomena caused by the moon during the eclipse of the sun, and also otherwise. The striking parallelism of increased darkness and increased intensity of sound at night is thus intelligible to us as resulting from the dependence of both phenomena upon the same ether.

Since we live within the organism of the earth with its present etheric structure, we therefore perceive the light, colour, and tone phenomena with our present waking consciousness only in the manner in which these phenomena there manifest themselves. For the perception of light, colour and tone, as these arise in other spheres of activity of the etheric formative forces, we require the adaptation of our consciousness to these altered relationships. Sound ether is naturally not restricted exclusively to these tone phenomena which it produces in the lowest levels of the atmosphere, where we live, through the conflict for the condensation or rarefaction of substance—that is, of the air. But in these spheres of the earth organism it always produces tone-phenomena in the manner we have here explained.

Goethe : " Prologue in Heaven "

RAPHAEL. The sun-orb sings, in emulation,
'Mid brother-spheres, his ancient round :
His path predestined through Creation.
He ends with step of thunder-sound.
The angels from his visage splendid
Draw power, whose measure none can say ;
The lofty works, uncomprehended,
Are bright as on the earliest day.

GABRIEL. And swift, and swift beyond conceiving,
The splendour of the world goes round,
Day's Eden-brightness still relieving
The awful Night's intense profound :
The ocean-tides in foam are breaking,
Against the rocks' deep bases hurled,
And both, the spheric race partaking,
Eternal, swift, are onward whirled !

MICHAEL. And rival storms abroad are surging
From sea to land, from land to sea,
A chain of deepest action forging
Round all, in wrathful energy.
There flames a desolation, blazing
Before the Thunder's crashing way :
Yet, Lord, Thy messengers are praising
The gentle movement of Thy Day.

ALL THREE. Though still by them uncomprehended,
From these the angels draw their power,
And all Thy works, sublime and splendid,
Are bright as in Creation's hour.
(Translated by Bayard Taylor, London, 1871.)

Chapter X

THE SHAPING OF SUBSTANCE, THE DISSOLUTION OF SUBSTANCE, AND RADIO-ACTIVITY

THE decay of substance, which has been revealed through the research of the last decade in the phenomena of radio-activity, has become one of the most essential components in our conception of the world. Moreover, it has furnished the evidence to prove that the transitory life of our present cosmic system (from genesis to heat-death) may be viewed, not only in its process of becoming, but also in its decay and processes of death, by man, who shares in this experience.

That this dissolution of substance proceeds spontaneously and apart from human interjection of chemical or physical influences has been completely established by present-day research in radio-activity. This dissolution is, therefore, for the present free from any arbitrary human will.

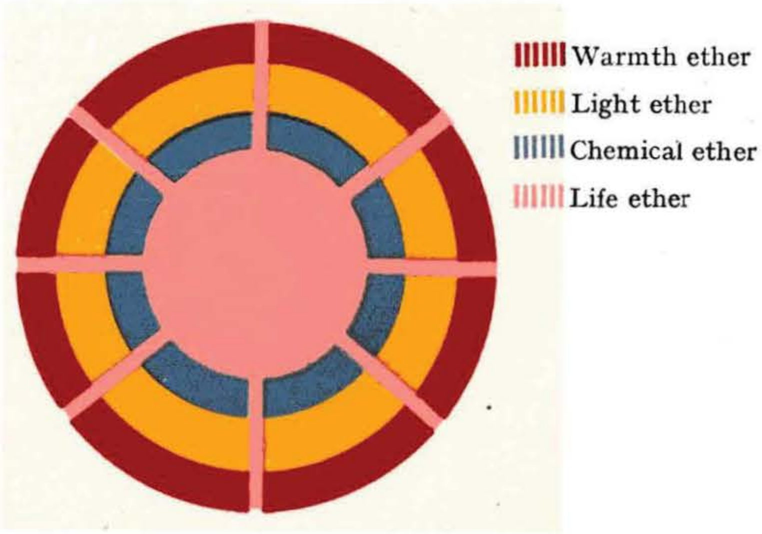
It was formerly supposed that the phenomena of radio-activity were attributes of certain special minerals. But it has been possible to prove, as Professor St. Meyer and E. von Schweidler state in their frequently cited work " Radioaktivität " : " That not only the minerals actually containing uranium and thorium, but almost all natural forms of rocks and soil contain radio-active ingredients." The content, therefore, of radio-active elements and the resulting evolution of heat in the most widely diffused forms of rock which compose the crust of the Earth are of essential significance for the ' warmth-household ' of the globe. In particular, research in radio-activity has shown that the methods whereby until now the age of the Earth's crust has been mathematically calculated has lost sight of reality. Dr. Kähler cites, furthermore, in his volume on " Luftelektrizität " (p. 117), the experimentally established fact " that radio-active substance is mingled directly with the air," and not only bound up with the solid outer crust of the earth. " Sea water shows likewise a slight but evident radio-activity " (p. 125). Further on he asserts, " Snow often manifests radio-activity," and elsewhere, " The radio-activity of the substances precipitated varies. In general, in proportion to the quantity of water, it is greater in snow than in rain." Finally, it has come to light that the air of the atmosphere, the air we breathe, is continually taking up the radio-active emanations of the earth's crust, and we have been able to follow this rhythmically coursing process while considering the process of breathing of the earth organism (Chap. III). We see thus from all these experiments that radio-activity reveals itself in all spheres and all elements of the earth organism. (Its consequent important influence upon man, composed, as he is, of the elements of the earth and living in the earth organism, we shall later take under separate consideration.)

Before we enter into a discussion of the phenomena of radio-activity itself, it may be well to remark briefly upon a phenomenon which can be understood as a component part of radio-activity only out of macrocosmic relationships. It has been discovered that radio-activity is most strongly marked in connection with substances of the most complex composition, and especially those terrestrial elements "to which, of all elements, belong the greatest atomic weight." Furthermore, it has been learned that products of the radio-active dissolution series are isotopes of lead—that is, that the most intensively dissolving substances in the earth organism are similar in nature to lead. I may be permitted here to call attention to the fact that in those spiritual traditions of Orient and Occident where much was known of the relation between macrocosmic and microcosmic processes without the apparatus of the astrophysics of our age, lead, on the one hand, was always accompanied by the sign of Saturn ♄, and, on the other hand, the oldest state of the cosmic system was also called the "Saturn state." Modern research has now established quite indisputably and quantitatively this relation between lead and the most complicated element of substance, most subject to dissolution. In the case of the spiritual teachings mentioned above, these weighty matters were known, associated also, of course, with qualitative attributes.

The discovery of this spontaneous dissolution of substance has led to a more thorough investigation of that small entity of substance called the "atom," and we shall now endeavour to arrive at a conception of the inner structure of the unit of substance.

Modern research seeks, of course, from all directions, to arrive at this important goal. We shall not now enter into the debate for and against the atomic theory, but shall only remark in regard to the theory that, although qualitative and quantitative characteristics are not arbitrarily separated, as they never are in reality, yet one can, in a sense, speak of the smallest entities of substance just as we speak of greater units, such as Earth, Sun, Saturn, and the like. Naturally, all these greater or lesser units may be converted further into still greater or still smaller units. We must realise most of all that, just as the greater units (the planetary, for instance) are in a process of metamorphosis and are distinct in nature from one another, so also the smallest entities of substance are not forever immutable, and these also will manifest different characteristics in the different elements. Thus an entity of the substance lead will be different from one of gold, copper, iron, etc. Yet they will all manifest certain traits in common because they are all subject to the general terrestrial laws. We shall here discuss these common characteristics. To those who do not seek to understand single phenomena torn apart from their inter-relationships, but endeavour to apply an organic conception even to single members in the system of substance, the phenomena connected with radio-activity and the substance unit in which they occur are best understood, in the light of reality, by comparison with the structure of the earth organism. While we shall naturally never be able to establish by means of our senses the most minute units of substance called the "atoms," we understand at once what occurs in such a microcosm by comparison with its greater archetype which is accessible in much greater degree to our actual observation.

Picture of the earth organism, and likewise of the substance unit.



(The whole is naturally not static, but in constant motion within the spheres, and the spontaneous radiation is irregular. Through the pink rays radiation is intended to be schematically indicated.)

Let us now apply to this model of substance, corresponding to the earth organism, that which has been proven by means of research in radio-activity.

In connection with the spontaneous dissolution of substance in radio-activity, there come to light primarily four concrete, experimentally confirmed activities:

(a) Heat activity,
(b) Light activity,
(c) Chemical activity,
(d) Activities affecting life processes.

(a) A unit of substance is vitally interpenetrated by centrifugal forces, on the one hand (warmth ether and light ether), and on the other hand by centripetal forces (chemical ether and life ether). Radio-active substances are always somewhat warmer than their environment, which is a result of the action of warmth ether released by the process of decay, not of any sort of inexplicable hypothetical "transmutation of energy." It has been experimentally proven that phenomena of radio-activity are entirely free from the influences of external temperature. Professors St. Meyer and E. von Schweidler proved conclusively the following very interesting fact: "The development of heat is, first of all, surprisingly great. It reaches such a degree, as more recent research has shown, that radium will always bring approximately 1⅓ times its own weight of water from the freezing to the boiling point in one hour. Similar phenomena were then established for the other radio-active substances" (p. 13). Warmth ether may thus be easily demonstrated as a formative force self-existent and coming to manifestation through the dissolution of substance.

(b) The phenomena of light in connection with radio-active substances rest upon the action of light ether and life ether, as we have described this action previously under other relationships. It is "pure light" (Chap. VII), for it is entirely independent of processes of combustion and heat. It has been experimentally proven, as we have said, that phenomena of radio-activity are entirely free from the influence of external temperature. The effects of light have been proven to come from those outer zones lying around the inner kernel of the entity of substance—that is, from the light ether sphere of the preceding diagram, so that there is here a complete correspondence with the description of the earth organism given earlier. All radio-active mixtures always form the threefold oxygen, ozone. The luminosity of radium is not dependent upon previous treatment with solar rays, for life ether and light ether are released through the dissolution of substance and express themselves in phenomena of light just as this happens on a large scale in the earth organism.

(c) The chemical action of dissolving units of substance is manifold. The metamorphosis of white phosphorus into red through certain radio-active rays is certainly to be ascribed especially to the release of warmth ether (see Chaps. VII and VIII). The hitherto observed contradictory effects—that radio-active substances at one time decompose water and at another time form water, and in the same way sometimes form ozone, and sometimes destroy it—may now be explained indisputably; for these things depend upon which of the etheric formative forces from the radio-active substances at the moment act upon the other substances in question. Life ether and light ether will form ozone; warmth ether will destroy it; chemical ether will form water; light ether will not, etc. It would at this point take us too far afield to discuss each individual phenomenon thoroughly on the basis of the etheric formative forces as these have been described. Anyone who is intimately familiar with radio-active processes will, however, admit that many of the phenomena he has heretofore observed can be very differently interpreted when these are viewed in a living way, in the light of the above analysis of the unit of substance with an inner structure similar to that of the earth organism.

(d) Very important are the influences of dissolving substance and the action of its forces upon the phenomena of life. As to this the work of Professors St. Meyer and E. von Schweidler furnishes an abundance of very interesting evidence. Men, animals, plants, and minerals, everything created—all are subject to this action. Minerals are influenced in the crystallization processes (see Chap. XI); plants in their vital element, chlorophyll; man in his blood and many other parts of his organism. The therapeutic significance of radio-active substance in the sources of all curative baths in the world—such as Karlsbad, Gastein, Baden-Baden, Nauheim, etc.—has been disclosed, indeed, in the last decade though not yet explained. Dr. Kähler says in "Luftelektrizität" (p. 125): "Those springs which have come to be known as curative manifest a high degree of activity."

Here let us demonstrate in the most penetrating fashion the difference between a merely quantitative and a qualitative manner of viewing the world. The life ether released from the dissolving substance breaks through all the fetters of a merely quantitative understanding. Like the cosmic formative forces which penetrate into the outer spheres of the earth organism (pp. 126-128), it not only forms the ozone, so vitally important, but reaches deep into the phenomena of life. The physiological effects of these released forces are almost all-comprehensive (St. Meyer and E. von Schweidler, p. 199): "The checking of fungus growths; the destruction of germinating force in seed; the checking of the growth of roots and buds and whole plants; acceleration of defoliation, etc.; atrophy of parts of flowers; stoppage of the development of the embryo-sac; degeneration in cell nucleus, etc., etc." Nägeli says in his work on "Blutkrankheiten und Blutdiagnose" (p. 171): "In so far as researches up-to-date have established conclusions, one must assume a twofold action of the Röntgen rays: 1. A direct destruction of the cells in the organs under radiation; 2. an indirect influence exerted upon organs not under radiation by means of a Röntgen toxin in the sense of a retardation of the cell formation and an approach of the cytogenesis towards the normal mode. Radiation with radium shows effects which correspond to those produced by Röntgen radiation upon the blood-generating organs." But the effect upon the phenomena of life in man, animals and plants depends directly upon the intensity of the action. A high degree of intensity is often destructive, where a low intensity is upbuilding, beneficial. *This, however, is most of all dependent upon the particular organism upon which the influence operates!* A science which, in applying these etheric formative forces does not base itself upon the conception of the etheric body of organisms, of men, animals, and plants, as it is here observed in relation to the most varied organisms, might, in spite of the utmost goodwill, occasion an unpardonable catastrophe in the world of the living, of organisms, by means of the newly disclosed forces as they come within arbitrary human control through the dissolution of substance. With the discovery of the forces which are released by the dissolution of substance—which, of course, have always existed but now for the first time become subject in increasing measure to arbitrary human control—the merely quantitative research into the world becomes a world peril.

The first bold investigators in radium have had to suffer in the course of their investigations the mutilation of limbs, a fact which brings a shuddering fear to those who do not close their eyes to the fact that these unexpected experiences may prove to be a mere beginning of the intensification of such phenomena whose meaning for the future evolution of living beings, and most of all the evolution of man, can scarcely be surmised in our day.

Only by drawing upon the knowledge of the ether body and the other essential members of the human being, as anthroposophical spiritual science represents these in our time from a spiritual source of knowledge, can we save humanity from encountering a calamitous confusion in the world of forces just as unexpectedly as the political world stood amazed and helpless before the catastrophe of the war and academic political economy before the consequent chaos in our national economic life.

In conclusion we may glance at the outlook for unified research into organisms and its future tasks in connection with the discoveries of radio-activity.

In relation to the appearance and extinction of species of animals and plants in different parts of the earth organism—to which we have already referred in Chapter III—it must be pointed out further that the phenomena of dissolution of substance, linked with the etheric processes, for which radio-activity is merely one of many manifestations, are of varying degrees of intensity in different "geographic" parts of the earth organism, a fact which will in future explain many a riddle in the sciences of ethnology, zoology, and botany. Minerals, water and air for breathing are quite differently interpenetrated by the etheric formative forces in different parts of the earth. This geographically varying action of the etheric formative forces in minerals, water, and air for breathing—that is, in those components, which form the bodies of plants, animals, and man in the different parts of the earth and influence their vital phenomena—belongs among the causes of the differences distinguishing the races of men and varieties of animals and plants. With the variation in the etheric structure of a particular geographic complex, there vary also the conditions essential to life, and with these the phenomena of life, among plants, animals, and men in that region of the earth. (This matter we shall discuss more in detail in Volume II.) Biological investigators who desire to understand the appearance and disappearance of races and species in the kingdom of life and their variations will in future be forced to pass over into a study of "*etheric geography*"—that is, research into the geographically varying activity of the etheric formative forces in the earth organism.

In this research it will be possible, among other things, to work from the basis of an investigation of the modifications which units of substance undergo in the various regions of the world, since these, as we have seen, reproduce in miniature the picture of the earth organism. *The model of the earth organism is also the model of the smallest units of substance,* which, however, go through their *metamorphoses* according to the different influences of the various regions of the earth and thus are more and more varied and individualized in space and time.

Chapter XI

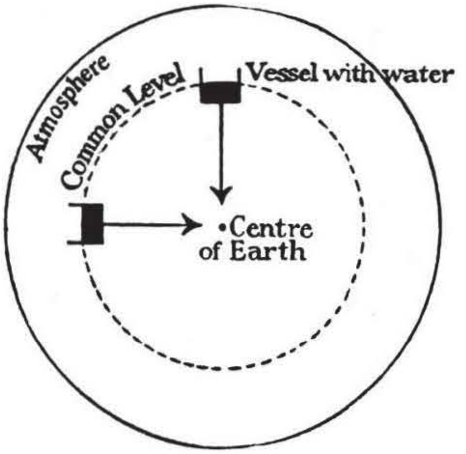
THE SHAPE-BUILDING FORCES AND ARCHETYPAL FORMS IN NATURE AND THE REALITY

IF we wish to penetrate with full understanding to the genesis of form-building in Nature, we must once more begin with the primal states, the states of aggregation of matter (Chap. II), as Dr. Rudolf Steiner has done in his second course of scientific lectures, with a tremendous range of vision over the most varied fields of scientific research. Here we shall endeavour to sketch briefly the wide range of these ideas and to place them in mutual relationship with what has been said in the preceding sections in regard to the etheric formative forces.

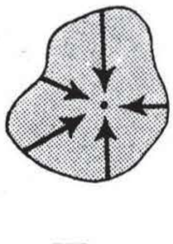
Fundamental for the understanding of form-building is the fact that expansion is a very different thing in the case of different solid, fluid, and gaseous substances—that is, that the co-efficient of expansion for solid and fluid bodies varies according to the substance which expands ; whereas this is identical for all kinds of gaseous substances. Expressed differently, the identical capacity of expansion of all kinds of gases is changed in the transition through the liquid to the solid state into a differentiated, individualized capacity for expansion for each individual solid substance. Here also we see that in the transition to the gaseous state there comes about a unification of all substances on the earth ; whereas, in the transition to the solid state there appears an individualization, a differentiation towards individuals. We are here dealing with a polaric contrast : *with gaseous bodies a surrender of individuality, of shape, of form ; with the solid bodies a demand for individuality, a thing's own shape, a special form.*

We must now ask ourselves : What is it which actually shapes, which individualizes ? Let us recall the various functions of the etheric formative forces within the earth organism. We have recognized two groups of forces working in polaric opposition : on one side warmth ether and light ether, the centrifugal forces which tend outward from the solid earth with the earth's atmosphere ; on the other side chemical ether and life ether, which hold together the earth organism. It is, therefore, the two latter forces which render possible the earth organism as it is, as a self-contained individuality. But they do this, not only for the earth organism as a whole, but also for all those individual bodies within the earth organism which exist in either the fluid or the solid state, adjusted to the chemical or the life ether. The life ether as a free force brings about not only the sundering of the earth organism from the cosmos, its individualization, but also the sundering from the earth organism of each single body within it. Ancient schools of wisdom—for example, those of Greece,—which had a great deal of intuitive knowledge of these things, for that reason called the solid state the " Earth " state, thereby expressing the fact that a body which comes into the solid state enters thereby wholly into subjection to the earth's laws.

This path toward individualization now moves in a manner which is amazingly symptomatic both for the macrocosm and for the microcosm. A gaseous substance tends always to break through the form imposed upon it ; it tends to release itself into the world in every direction. If I wish to give it a form, I must surround it on every side. Not so the fluid body. It also tends to break through a form imposed on it, but not in every direction. We do not need to hold water in a vessel closed on all sides. Though we must surround it with a shaping form below and at the sides, it shapes its own form above. And what is this form ? *The form of the earth as a whole !* We call this the water-level, but it always takes the form of a sphere whose centre coincides with the centre of the earth.



Finally, in the case of solid bodies that which in the case of water is directed toward the centre of the earth is transferred to the inside of the individual, differentiated body itself. What is shaped by the whole earth in the case of an aqueous body—the water level—is shaped on every side by the solid body itself. By taking in the life ether, the force of gravity, it has taken over within itself the earth force ; it is individualized.



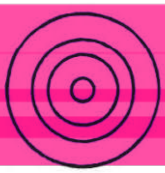
We may summarize as follows : Gas opposes the earth's laws of form ; will not submit, like the other states of matter, to the earth relationships ; tends away from the laws of the earth in order to return to cosmic laws. It denies the sundering, individualizing process toward which the earth tends as opposed to the cosmos ; its tendency is anti-individual.

The watery, or fluid, substance is subject to the laws of the earth only in part, in that it permits itself to be given its level, its form on its upper surface, by the earth forces tending towards the centre of the earth. But this shape is common to all fluids in the earth organism and is, therefore, not individual. For the rest, the fluid has the same form-denying tendency as the gaseous. *It is thus a medium state between purely cosmic and purely terrestrial laws.* Solid bodies, finally, take over into their own interiors the same form-shaping forces which are common to all watery things in the earth organism; they completely individualize in themselves the "earth state."

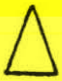
Thus we see:

Warmth ether—heat Light ether—gaseous substances	have anti-individual form-tendencies.
Chemical ether—fluid substances	partly anti-individual, partly individualizing, form-tendencies.
Life ether—solid substances	purely individualizing form-tendencies.

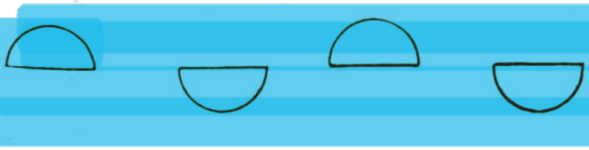
Let us here examine more closely these form tendencies of the etheric formative forces in the several kingdoms of Nature. We have said (Chap. II) that these formative forces, when they work in the world of substance, show a tendency to shape the following basic forms:



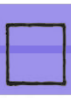
Warmth ether: spherical forms



Light ether: triangular forms.



Chemical ether: half-moon forms (giving, when completed, a circle or a globe).



Life ether: square forms.

How the manifold other structural shapes proceed from these basic forms we shall now inquire.* Indeed, these four basic forms are brought before us in all the kingdoms of Nature if we look with living vision;

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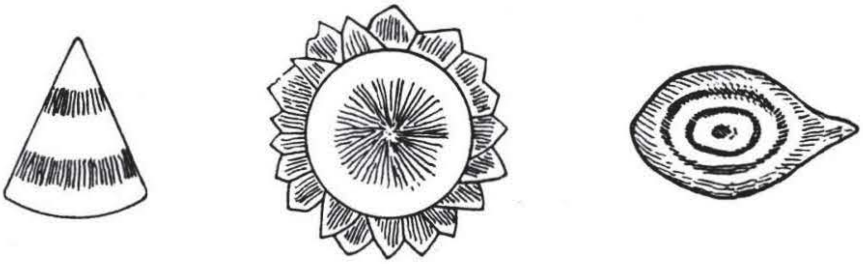
* Exceedingly important and very instructive in their bearing upon the genesis of primal forms and their transition, one into another, are the representations given by Dr. H. von Baravalle in "Geometrie in Bildern" (Stuttgart, 1926).

in what follows here, we can naturally select only a few characteristic examples.

When salt dissolved in water crystallizes out of the fluid into the solid state, it takes the square or rhomboid shape as its basic form. Here is manifested the action of life ether. According as the other etheric forces work together in the various chemical elements during their crystallization, there arise triangular or spherical forms, or mixed forms.

Very striking does this conformity of the several basic forms with the corresponding formative forces within the earth organism become in the case of hail, rain, snow and the like—that is, those *shaped* substances which fall down to us from the upper atmosphere. What forces are active in their individual shaping has hitherto been hidden behind a dense veil. In his interesting book " Meteorologie," already cited many times, Professor Trabert writes : " In relation to the formation of hail, the points of view are not yet clarified. It is certain that in this and in every heavy rainfall . . . there comes into play a very intensive and sudden condensation : that a hailstorm is a real tempest in which precipitation takes place partly in the form of ice." Beginning from our present considerations, we reach the following conclusions : Hail represents a transition from the gaseous state through the liquid to the solid *which occurs in the light-ether sphere of the earth organism.* Hail is solidified, therefore, under the general laws of light ether, which produces triangular shapes. In fact this is visible in the shapes of hail stones, which can generally be recognized as variations of the forms in the following sketch.



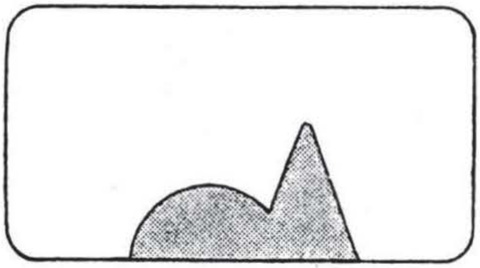
Hail stones (after Professor Trabert)

Thus we see the triangle of light ether which it gives to substances " shooting into form " in the light-ether sphere.

In this phenomenon the earth organism demonstrates to us how the previously formless substance is seized suddenly by the shape-creating forces, the etheric formative forces, and how *the newly shaped form is an expression of that etheric force in whose sphere and through whose co-operation the shape-creating occurs.*

In the second cross-section, indeed, we have an illustration of two processes. The chemical ether, whose half-moon-shaping force when working from all sides equally, produces the sphere, has, through its suctional action from the centre upon the outer parts of the sphere, caused the condensation of the gaseous into the fluid by sucking together the substance (Chap. IV) ; in addition, during the hardening of the now fluid substance to solid, the light-ether sphere of the earth organism, in which the hardening to ice occurs, has imposed the triangular external forms.

It may be well at this point to call attention to another especially striking example to which we shall later return in discussing the human organism. We have seen that the breathing process of the earth organism (Chap. III) exhales chemical ether outward into the light-ether sphere, and sucks it inward in rhythmical alternation, and that upon this activity of chemical ether depends the formation of clouds, the process of condensation. As we shall see, human breathing (which, indeed, stands in direct relation to the breathing of the earth organism : showing the time-ratio of approximately 1 : 25,920) depends upon a similar alternating action of chemical-ether and light ether. Anyone can now undertake the following peculiar experiment and prove for himself that if a smooth piece of plate glass is held directly under the nostrils of a living man while he breathes, so that the exhaled humid breath strikes the glass, the reciprocal action of chemical ether and light ether will manifest itself in the following forms :



Half-moon form. Triangular form.

Since the process is completed very quickly, one can best observe it in relation to another person. The triangular form and by its side the half-moon form can always be recognised in this precipitation from the breath. (See also p. 205 ff.) Of course, the triangle may be at the left and the half-moon form at the right. This depends upon the state of the vital current in the person at the particular time of day, as we shall later explain (Chap. XII). We shall point out very clear-cut primal forms in the case of the blood crystals of men and of animals. The essential point in the above matter lies in the complete similarity of the activity of the shaping forces in the earth organism and the human organism. Whether the etheric formative forces now cause the condensation process in the earth organism and stamp a certain shape upon the hail while it is shooting into the solid state, or whether they stamp a shape upon exhaled breath of the human organism, the same etheric formative forces will always call forth in Nature the same basic shapes. The more man individualizes himself in future in his inner etheric structure the more complicated and individually distinct forms will his exhaled breath assume. We here stand at the gateway of the most important sphere of future evolution.

This living, shaping activity of the etheric formative forces we can view best in the development of plants. Here again Goethe achieved a preliminary scientific work which cannot be too highly valued. He was able to make discoveries to which the spiritual tendency of a mechanistic, dead conception of the world and abstract formulæ in regard to the organic and the living could never attain. In his work on " Goethe's Conception of the World," Rudolf Steiner has expressed this in those significant words (p. 138) : " Perception with the eye of the body imparts knowledge of the sensible and material ; perception with the eye of the spirit leads to the perception of processes in human consciousness, to the observation of the world of thinking, feeling, and willing. The living union of the spiritual and bodily eye makes possible the knowledge of the organic, which as a sensible-supersensible element, lies between the purely sensible and the purely spiritual."

Indeed, Goethe experienced in the " basic organ metamorphosing its shape gradually as by a spiritual ladder from seed to fruit " the idea of the " archetypal plant." " The archetypal plant is the creative element in the plant world. If one wishes to explain a single plant species, then one must show how this creative element works in that special case. The thought that an organic being owes its form, not to the forces formatively acting in it, but to the fact that the form is imposed upon it from without for certain ends, was repulsive to Goethe."*

At this point we can only refer to the splendid discussions of Goethe which he supported with innumerable evidential instances in Nature. Everyone who wishes really to penetrate into the realm of the organic should lay to heart the writing of Dr. Steiner mentioned above concerning the world conception of Goethe. In regard to the shaping of the plant out of the seed, he says : " The germination, the growth, the metamorphosis of the organs, the feeding and reproduction of the organism—to conceive all these things as sensible-supersensible processes was the constant endeavour of Goethe in his studies in plants and animals.

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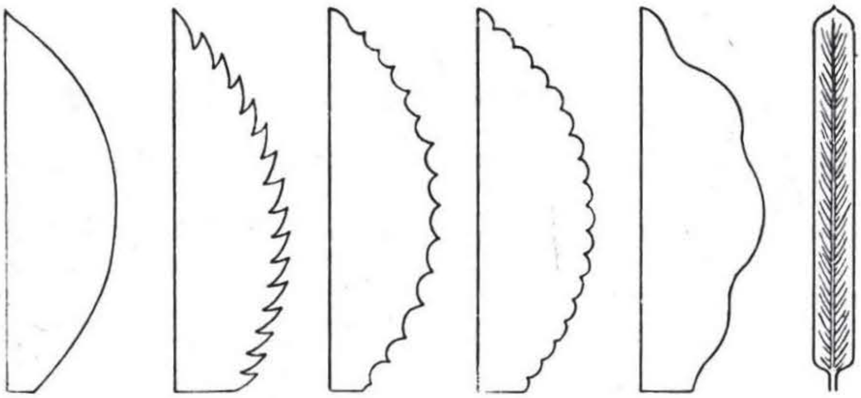
* G.C.W., p. 122,

He observed that this sensible-supersensible course of events is in idea the same for all plants and takes different forms only in external manifestations. Goethe was able to establish the same thing for the animal kingdom. If we have formed the idea of the sensible-supersensible archetypal plant, then one will find this in all individual plant forms. The multiplicity arises from the fact that what is similar in idea may exist in many forms in the perceptual world. The individual organism consists of organs which in turn are to be traced back to a basic organ. *The basic organ of the plant is the leaf with the nodes from which it evolves.* This organ assumes various forms in its external manifestations—germinal leaf, foliage leaf, corolla leaf, corona leaf, and so forth. The plant may sprout, blossom, or bear fruit, and yet it is always the same organs which in various modifications and in frequently altered shapes fulfil the prescription of Nature."*

This view of the leaf as the basic organ of the plant had to be introduced here in order to be able to illustrate the activity of the etheric formative forces in the shapes which are assumed by this primal organ, the primal plant, the leaf. *In the form of the leaf and its periphery are recognized the form-tendencies of those inner formative forces which once gave the initial impulse to the " shooting into form " and which are finally fixed, as it were, in this form*—that is, of those formative forces that are dominant from time to time in the genesis of the various species of plants.

We may, perhaps, distinguish the following basic types of leaf peripheries which, of course, modify and repeat themselves in the most manifold varieties and transitional forms.



In some instances the influence of the form-tendencies of the four formative forces may be demonstrated. In many of the examples this shows itself in the shape of the whole leaf ; in others in the periphery.

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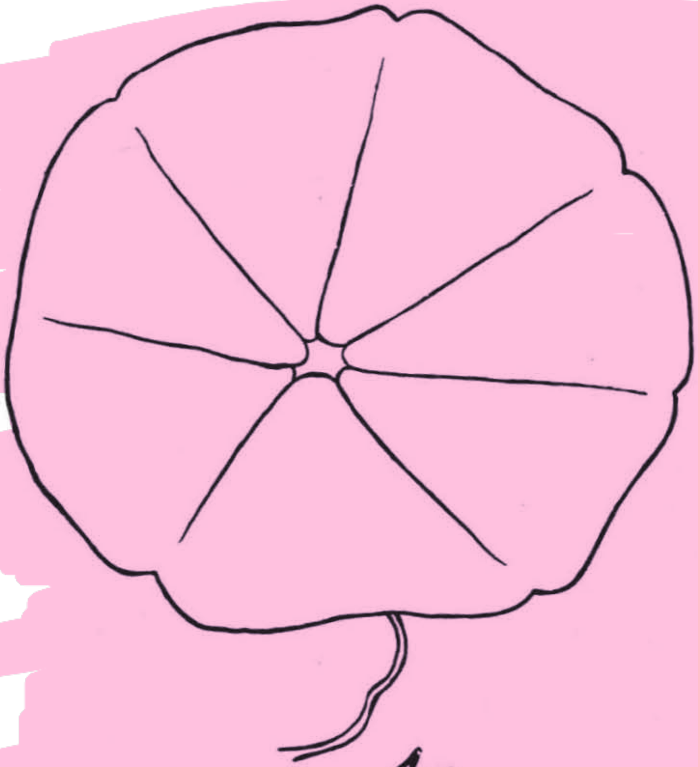
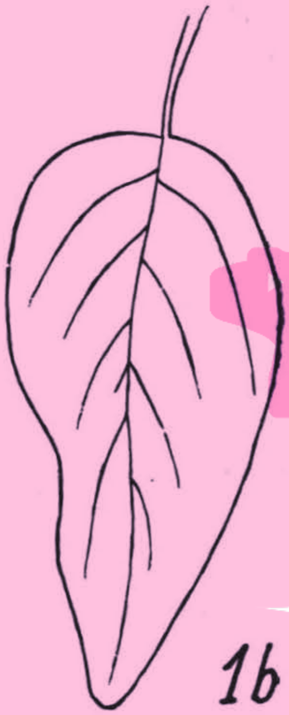
* G.C.W., p. 110.

Warmth ether:

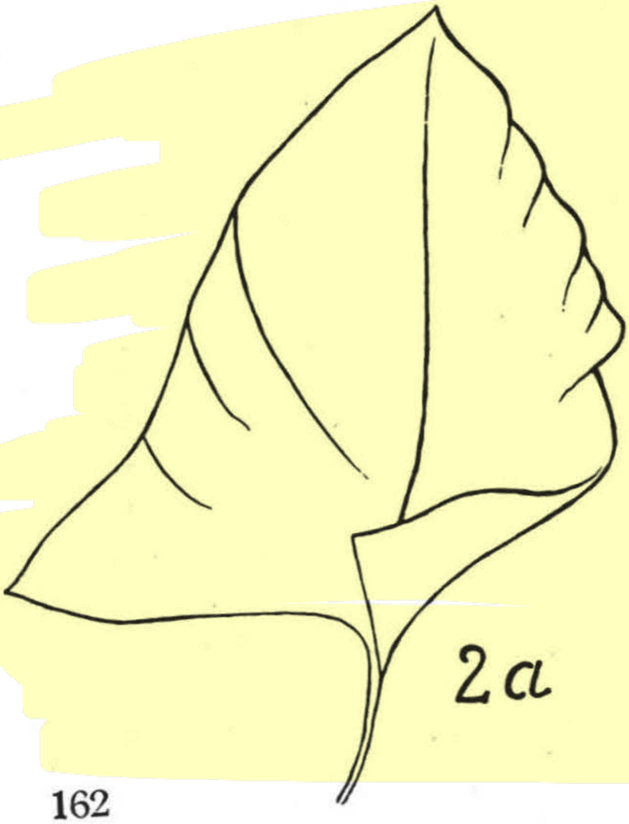


1a

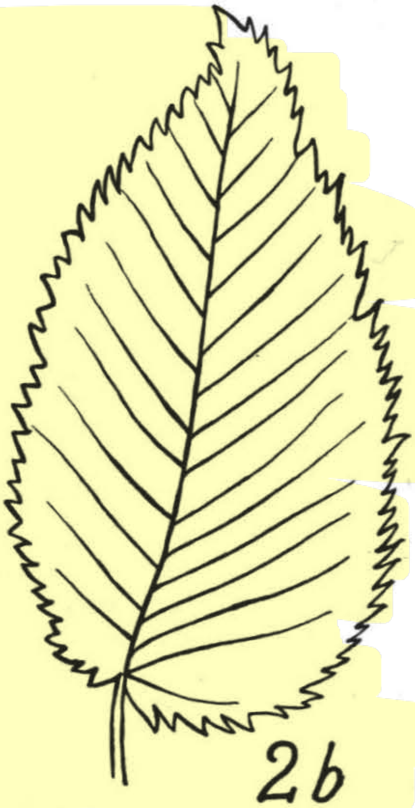


1b

Light ether:

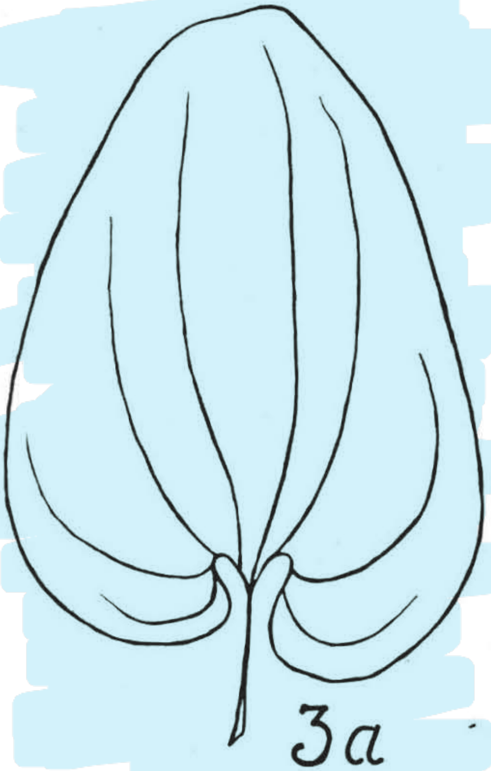


2a

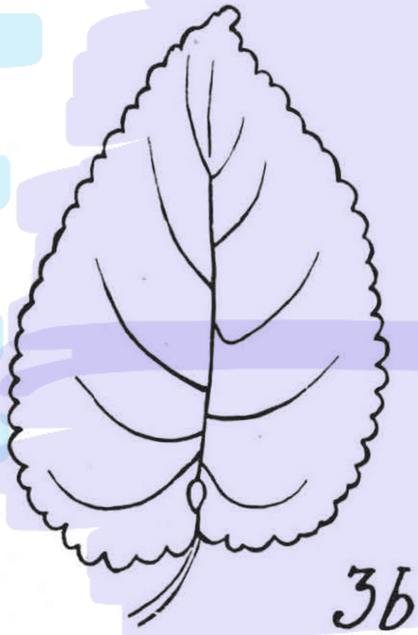


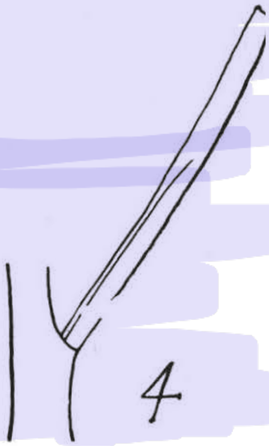
2b

Chemical ether :



Life ether :

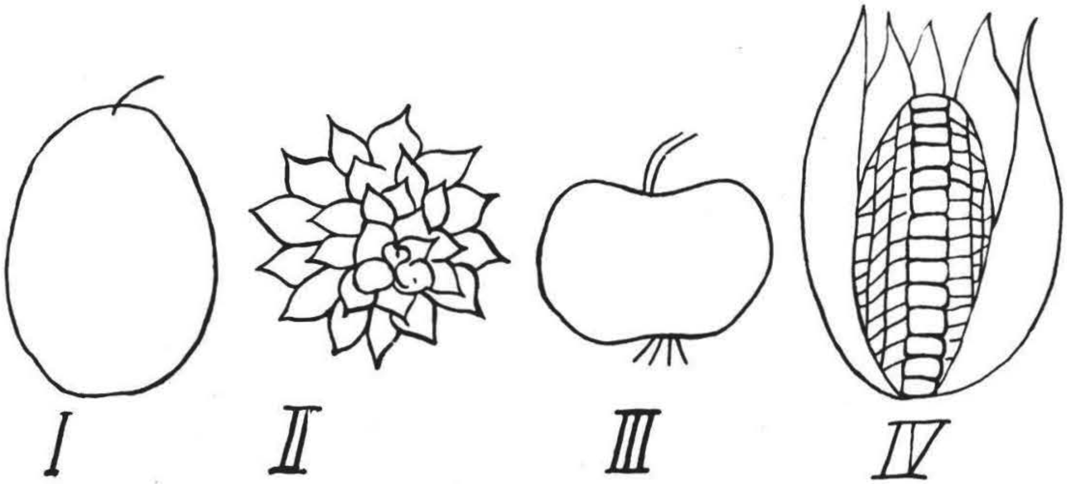




(1*a*) Nasturtium (*tropaeolum majus*) and (1*b*) Black Pepper (*piper nigrum*) show the spherical physiognomy of warmth ether, which, after having impelled the plant to a certain form, had to be solidified in this shape in the mature plant. (2*a*) *Philodendron simsii* and (2*b*) hornbeam (*carpinus betulus*) bear the physiognomy of light ether, which impresses its triangular tendency, indeed, upon most leaves. In (3*a*) Birtwort (*aristolochia rotundifolia*) and (3*b*) Sweet Violet (*viola odorata*) there is manifest the dominance of chemical ether, tending toward the half-moon form. (4) Spruce (*picea excelsa*) bears the form typical of life ether, which tends to realize its square shape.

In fruits also can be found the form-tendencies of the formative forces dominant in the shaping of the fruits. As examples of the influence of warmth ether, light ether, chemical ether, and life ether, the series below may serve.

For the reciprocal relation between the growth of a plant and the shape-building etheric formative forces, the following result obtained by research, as reported by Professor A. Hansen in his comprehensive volume " Die Pflanze," is illustrative : " Thus, for example, the formation of primary round leaves of *campanula rotundifolia* is a result of the slight illumination to which the young plants are generally exposed. If the young plant is cultivated continuously under these conditions, it will produce nothing but round leaves without the appearance anywhere on the stem of the narrow leaves which appear under normal conditions. It is noteworthy that at times entirely different external conditions will bring about the same forms."



(I) The plum. (II) The fruit globe of the bur-reed. (III) The apple.
(IV) The four-cornered grains of maize.

These processes teach us two things :—First, that in the absence of light, warmth ether and chemical ether come chiefly to activity, and this is shown in the circular and bow-shaped forms of the round leaves. (For the relation of chemical ether and warmth ether to the activity of darkness as an active force, see the Theory of Colour, Chap. VIII.) On the contrary, the arrow-shaped, or pointed, leaves appear only when light ether, with its triangle-forming tendency, is not suppressed, but is stimulated.

Most convincing of all are certain experiments in connection with ombrophilous (shadow-loving) and ombrophobous (shadow-hating) plants. Plants with a tendency toward shade, that is toward darkness, develop round leaves ; while those with a tendency toward light develop pointed, serrated leaves. These phenomena can be understood only on the basis of the theory of ether. In light, the stimulated light ether imposes its triangular symbol on the leaf so that serrated and pointed leaves occur. (See pp. 161-162.) But if, instead of light, shade or darkness predominates, then even the triangular form on the border of the leaf disappears and there appear spherical or scalloped leaves.

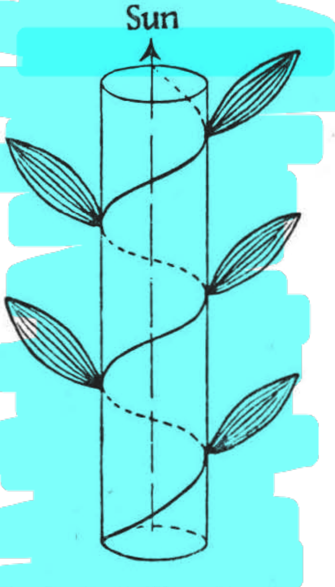
The fact, however, that at times the same forms arise in plants under contrary conditions—this proves that there is a self-sufficient inner force-structure, the ether body, determining the whole development, the growth and the motions and shape-building of the plant ; and that this determines whether in certain processes the plant shall respond to external influences seeking to affect it, or shall not react to them.

Since up to the present men have had no sort of vision of the laws of the shaping forces in the plant substance, the protoplasm—so that Professor A. Hansen even says: "Of the inner relationships of this protoplasm we cannot form any conception. . . . We understand the life processes of plants only up to the point where we must halt before the activity of the protoplasm"—therefore we have now made a great advance toward understanding when we can point out concretely in what manner the individual etheric formative forces impose their shape-forming tendencies upon the protoplasm of plants.

The action of cosmic influences in the development of the plant world is displayed to us—among other ways—in considering the principles according to which the leaves in certain plants grow along the stalk toward the sun. Long ago Dr. Steiner pointed out in connection with this *how the motion tendencies of the several planets are followed in the spiral arrangements of leaves around the axis of the stalk.*

The unique inner laws which are obeyed in the circling of the leaves around the stem in various sorts of plants, as the stem grows toward the sun, have given rise to extensive and varied research by specialists. It has become evident that the leaves always arrange themselves in spirals round the stem. Even opposed leaves and leaf whorls are no exception.

But the latest researchers in this field have recognised the inapplicability of the mechanical hypothesis; so that O. Schüpp, for example, in "Berichte der Deutschen botanischen Gesellschaft," says in his paper on "Konstruktionen zur Blattstellungstheorie": "We must not expect that a more complete knowledge of the laws of leaf-placement will 'explain' these phenomena in that sense that they might be derived from physical-chemical necessities which are in themselves only by-effects of evolution. The mechanical theory which sets forth contact and pressure as active factors; the nutritional-physiological conception which assumes a competition of the germinal stages in the search for food; and likewise the theory of Schoute of the diffusion of growth enzymes—all these can, indeed, render intelligible the equidistance of the leaves and whatever



The leaf winding about the stem of the plant, which is growing toward the sun imitating thus the motions of the different planets in the cosmos.

follows mathematically from this, but in the case of the laws of placement which we now have under consideration this very rule does not apply."

Just as in the explanation of the vital phenomenon of the " rise and fall of water " in the plant kingdom in the course of the year (pp. 57-59), so also in the interpretation of the unique growth curve in leaf formation, the purely mechanistic view has acknowledged its defeat.

But we understand this microcosmic process as soon as we look upon the macrocosmic curves described by the planets in the ether ocean of the world organism.

The spiral lines described by the several planets in the motions in and with the solar system in the ether ocean of the macrocosm are repeated in the spiral lines which, in different species of plants, the leaf placement describes on the stem as it grows toward the sun. It is illogical to admit only the action of the sun and not also that of the planets in the growth phenomena of the plant world ; for, since the etheric formative forces control the motions of the enormous planetary organisms in the ether ocean of the cosmos just as they control the motions in the micro-organism of the plants, so we see in both processes the same rhythms, forms, and motion tendencies.

A future science of botany, penetrating within the reality of the organic, will be able to bring into harmony the laws of this spiral placement of plant leaves around the stem growing toward the sun and the macrocosmic laws, by taking into account the etheric planetary " spheres " of which we have spoken (Chap. III).

How delicately the plant world reacts to the stimulation exercised upon it by the surrounding spheres of force becomes evident through the fact that not only, as Hertwig says, " is the form of growth of the chlorophyll-containing plants dependent upon their position with reference to the light falling upon them " (p. 384), but the assimilation and metamorphosis of material is entirely different according as a plant is reacting selectively to the action of one or that of another of the forces. In this selective reaction to the influence of external forces, or stimuli, lies chiefly the individuality of the living organism. I would here refer also to the strong reciprocal action between the plant kingdom and the horizontal and vertical currents of the earth organism.

Hertwig points out, for instance, " Werden der Organismen " (p. 385), the interesting phenomenon that, " In the case of algæ of different colours, the lights whose colours are complementary to those of the plants themselves have the most marked effect upon assimilation. . . . Only just beneath the upper surface of the sea are algæ coloured green ; with increase in depth these give way to the red floridæ and other red kinds of algæ. This is in harmony with the fact that the depth of the layer of water changes the quality of the light passing through. Even at moderate depths, as Engelmann has shown, the green and blue-green rays have a relatively greater . . . intensity, the red and yellow a relatively lower intensity than in the original light. Therefore, the green and blue-green rays of the spectrum, penetrating to greater depths, must call forth in the algæ cells there living a complementary colouring—that is, red. For it is just the green rays which have the most powerful effect upon assimilation through the agency of the red modification of the leaf-colouring material." A similar assertion may be proven of plants growing in the air. But we now understand, from the theory of colours (Chap. VIII) that certain specific etheric formative forces are responsible for certain light and colour activities (for example, light ether predominates in yellow; warmth ether in red, which is naturally less intense in deep water; and, on the other hand, chemical ether—showing itself in blue—is especially active, of course, in the watery element adapted to this ether, whereas the reverse holds good for the atmosphere). We know on the other hand from the variations even in the inert magnetic needle, that a concrete, measurable influence from the planetary spheres, of the macrocosm in general, is everywhere present (Chap. III); and we are, therefore, no longer forced to restrict ourselves in the measuring and interpretation of such influences to inert substance, the magnetic needle; but can advance to a concrete knowledge of the laws according to which the individual and the species in the living kingdoms of Nature respond selectively to the action of these forces of the macrocosm—indeed, much more sensitively and strongly than does the inert magnetic needle. Only we must hold firmly to one consideration: that is, that in the case of lifeless substance we have to do with only one factor, the mutable force-complex of the surrounding sphere of forces; whereas the living being reacts upon the influence of the surrounding sphere of forces according to its own individualized inner laws. It is on this basis that we can explain why one plant grows with its leaves toward the sun in this, and another in that, spiral imitating the planetary orbits, or why a plant selects a certain external colour, and what shapes it gives to the periphery of its leaves, and hands down by heredity generation after generation. The ether bodies of small and also of great organisms here again manifest to us the harmony existing between macrocosm and microcosm.

Heredity

When by this means we can penetrate into the development of the world of forms through the action of the etheric formative forces, then the question thrusts itself upon us, to what extent is the form of an organism an entirely new creation and to what extent is it determined by the forms of those organisms through which it has come into existence by a process either of division, or of metamorphosis, or of sexual procreation ? Here we enter into the field of the theory of heredity, which is almost completely veiled from human knowledge. Oskar Hertwig, in his work " Das Werden der Organismen," has applied to that most minute unit out of which the organism develops, in an ontogenetic process of evolution, the term " species cell."* He says, (p. 512) : " All the riddles of biology, to which the greatest investigators of all time have applied their keenest minds rise up before us in the question, how has the species cell with its predisposition come into existence ? " Elsewhere (p. 512) : " Since heredity through the germ cell and the carrying over of acquired characteristics takes its course in a sphere quite beyond the reach of any visual means of knowledge which we possess, all conceptions, therefore, that we can form of this matter are obviously of a hypothetical character." Again (p. 529) : " In viewing the intimate causal relationships which exist between the fertilized egg and the organism developed out of it (ontogenetic law of causality), we point to the germ cell as a predisposition or as a substance endowed with specific potentialities. From this point of view we may say without being misunderstood : ' The egg and the sperm cells represent the later elaborated phase of development in the form of an inherent predisposition, or the state of a species cell. To this extent finally there come together in the species cell all biological problems which have to do with the nature of heredity or with the origin of species. With the conception of the predisposition and of the species cell we combine also the conception of an extraordinarily compounded substance and of an organization which lies far below the limits of the microscopically visible." Then, developing a saying of Nägeli, he continues : " In order to grasp the conception of inheritance we do not need for every distinction conditioned by time, space, and inherent character a self-existent and separate symbol, but a substance which, through the fusion of its elements, present in limited numbers, is able to manifest every possible combination of differences and to pass over through permutation into another combination of these. In order to clarify this matter, I have made use in my " Allgemeine Biologie " of two conceptions. Although the letters of the alphabet are limited in numbers, yet by the combining of these it is possible to form words and by combinations of words to form sentences of the most varied meanings. Just so, through the succession in time of a small number of tones one after another, and the various combinations of these tones, numerous harmonies may be produced.

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* German : Artzelle.

In chemistry the proteins show us how, through the most varied applications of a small number of elements, unnumbered high molecular combinations with characteristic peculiarities come into existence, and how these in turn, through the substitution of one component for another, can readily be changed in definite ways. Of how much greater multiplicity, then, must be the capabilities of a species cell, since not only is it composed of very many compounds of proteins, but these provide in turn the material for biological combinations still more complex and capable of the most varied combinations." Again (p. 546): "The substance which contains everything that is handed down as inherited potentialities by the parents to their offspring is already in itself an elementary organism; it is the species cell differentiated as egg or sperm cell. . . . The plan provided in the species cell can be realised and carried out in the developed organism only through a process of evolution. This evolution, however, depends in the first instance upon the increase of the species cell through a constantly repeated *division* of itself after preceding *growth*. From this point of view I could, therefore, designate the completed organism as the species cell raised to a higher power. Without considering this fundamental fact of evolution, no understanding is possible of all the phenomena of heredity associated with growth, as we are eloquently taught by the history of biology throughout the past 500 years."

Hertwig, who marks very admirably the frontier between actually attained knowledge in the realm of the theory of organisms and the often fantastic hypotheses of some followers of Darwin, says finally (p. 547): "In what possible manner these hypothetical particles really work together in individual instances in the formation of the visible qualities of the developed organism—this has thus far so completely escaped our understanding that we feel it is too early even to form a hypothesis in regard to it. . . . In my writings I have always held firmly the thought first clearly stated by Nägeli, and have often emphasised it: that, in dealing with the theory of heredity, one means no more by the term *predisposition* than that unknown cause laid down in the nature of the hereditary stuff, or the unknown basis of a phenomenon which in the course of the evolutionary process comes to light in conformity to law. Although it may perhaps seem permissable on the one hand to search for this unknown cause in the material nature of the hereditary stuff, it would be entirely arbitrary and false to believe that this could depend only upon the presence of one definite material particle, one special bioplastin or determinant, etc. It may just as well consist in the special placing of a bioplastin in a system of others, or in a special combination of two or more bioplastins in a more intimately related complex: in general, therefore, in what we may call the configuration of the material system or of certain of its component parts."

In this matter, therefore, Hertwig tends away from the position of the materialists, who would seek to discover the inherited tendency only through research into the substance transmitted by heredity, whereas Hertwig places the essence of heredity not any longer in the inherited substance but rather in the inner structure of the substance. He says (p. 536): " As I think I have shown in the few instances cited—whose number could readily be multiplied—it is scientifically an absolutely illegitimate method of procedure to assume, after the fashion of Aug. Weismann, that all the form-states and their corresponding physiological effects which come forth during the process of evolution already exist in separate particles of stuff of a metaphysical minuteness (the determinants) in the germ cell, and then to use this evolution-mechanism, preformed in the germ-plasma, as an apparent explanation of the actual evolutionary process, and even in every relationship and in connection with the most difficult problems." He finally adopts in convincing manner the fundamental assertion of Nägeli: " The structure and the functioning of organisms are in the main a necessary consequence of forces indwelling in the substance and are therefore independent of external contingencies. . . . The shaping and organizing of substance by virtue of its indwelling forces may be designated as the great common problem in every branch of science."

The task, then, of biological research is that we should *explore that inner force-world which determines the evolution of the developing organism.* Hertwig says (p. 572): " We must for the present frankly resign ourselves, keeping our minds open to the fact that we are still far from having attained to a view into the masterful play of forces at this point, the dynamics of a living, many-celled organism—indeed, we scarcely see any road by which to approach this goal. Nevertheless, in full consciousness of the insufficiency of our present knowledge, we need not despair of making advances in future as yet undreamed of."

Let us now endeavour, by way of the view of the etheric forces developed in the preceding chapters, to find that path which leads to an understanding of the forces active in a living organism and also to a solution of the problems of heredity. When Hertwig says in convincing fashion (p. 76): " Predisposition in the theory of heredity signifies no more than that unknown cause laid down in the nature of the germ cell, or the unknown ground for the unique course of a process of evolution which leads through fixed laws to a certain definite organization of the final product," then we may follow him with the statement that *the " predisposition " which takes over the organism as inherited and then develops it is its ether body.*

We will indicate this in the concrete example of the heredity of leaf forms (that is, in Goethe's sense of the forms of the archetypal plant), by comparing what has been said hitherto concerning the shaping of leaf forms by the etheric formative forces (p. 161 ff.) with that which the Augustinian monk Gregor Mendel has experimentally established by means of his well known researches.

Correns crossed* two species of stinging nettle for instance, and observed the results of such an hybridisation in order thereby to investigate the nature of heredity. O. Hertwig describes the results in a fascinating manner. One variety of stinging nettle, the *Urtica pilulifera,* has deeply serrated leaves; the other, *Urtica Dodartii,* has almost smooth-edged leaves. These two were crossed. The result of the union of this pair of parents was the following. The mixed breed resembles only the one parent, the *Urtica pilulifera ;* it possesses deeply serrated leaves.

O. Hertwig says (p. 74) : " Here the characteristic of one parent has completely suppressed that of the other in the offspring of crossed breeds ; has, as it were, won a victory over the other. . . . But the characteristic of the other parent, which does not appear in the offspring resulting from the crossing, we call a latent or recessive characteristic. . . . Here arises the hard question raised at the most various times : *How can one conceive the transfer of the characteristics of the two parents to the product of their union ?* The only certainty is our knowledge, based upon the results of cell theory, that the sole bond which unites successive generations consists of the germ cells released from the sexual organs of the parents. Through the union of these germ cells in the act of impregnation, these germ cells provide the material basis for the organism of the offspring. Therefore, the characteristics of the parents must be transferred—or, as we generally say, inherited—by means of the material endowed with forces—on one side that of the ovule and on the other that of the male germ cell."

If we now bring to bear at this point what has been said concerning the shape-forming action of the several etheric formative forces, the process of heredity will in this case become directly perceptible and entirely clear in its general principles. We have shown that the serrated leaves owe their form to the fact that the light ether has impressed its triangular shape on these leaves during the process of growth and evolution. We said : In the form of the leaf periphery we recognize the shape

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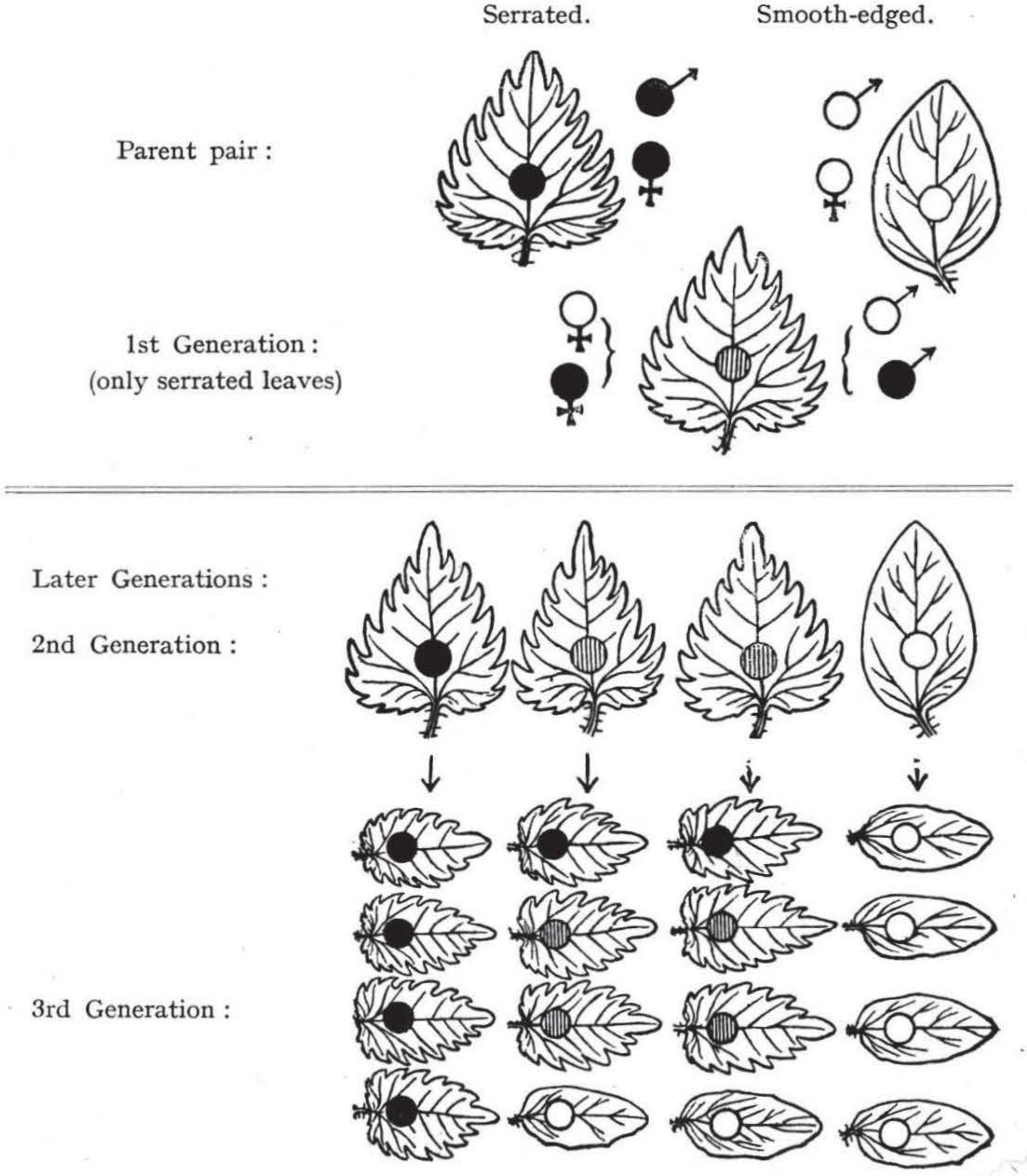
* See also, in reference to the propagation of plants, A. Usteri : " Versuch einer geisteswissenschaftlichen Einführung in die Botanik." Zürich, 1923.


Serrated.
Smooth-edged.
Parent pair :
1st Generation :
(only serrated leaves)
Later Generations :
2nd Generation :
3rd Generation :

Hybridization of *Urtica pilulifera* (left) with *Urtica Dodartii* (right).
First generation which, in spite of being a hybrid (ruled shield), shows only the predominant leaf form of *Urtica pilulifera*. Their sex cells, divided into " blacks " and " whites " give in the second generation two hybrids in proportion to each pure *Urtica pilulifera* (black shield) and each pure *Urtica Dodartii* (white shield). In the third generation the right and left offspring are constant while the hybrids show further Mendelian change. (Taken from Hertwig, " Werden der Organismen.")

tendencies of those inner forces which once induced the " shooting into form," that is, of those forces which were dominant during the time of the genesis of the various plant species (p. 161) and which are, so to speak, solidified in these final forms—thus the serrated leaf bears the symbol of the light ether. If now we cross a plant whose leaves are serrated with another whose leaves are smooth-edged (see diagram), then, as has been proved by Mendelism experimentally, the serrated leaves alone are inherited in the first generation. But this signifies nothing more than that, when the shape is produced in the case of one parent by the warmth ether (spherical, smooth-edged) and in the case of the other parent by the light ether (serrated, saw-toothed), then in the plant offspring the light ether will determine the shape in the " shooting into form," and the warmth ether becomes latent—that is, becomes inactive in the physical process. Just as in the metamorphosis of states of aggregation of matter certain forces (for example, warmth ether) come forth out of their latent state and begin to be active in the physical process, only to disappear again in other processes into the latent state—that is, remain physically inactive—so in this case only the light ether acts upon the germ-cell, the embryo of the plant offspring, in the building up and shaping of the growing plant, while the warmth ether, the specific shaping force of the other parent, remains " latent "—that is, does not share in determining the shape of the growing plant offspring. Often the etheric formative force which has become latent first comes again to activity in the second or third generation. Therefore, in the case above, the plant offspring in the first generation will bear only the triangular symbol of the light ether—that is, will have serrated, saw-toothed leaf forms. The predisposition of the species cell—*that is, that which is inherited in the embryo, which determines by law what it will become—is the ether body. The essential, therefore, in heredity is not the substance of the germ cell but its etheric structure—that is, those etheric formative forces which chiefly determine the coming into existence of this organism.*

As in the case of Chladni's figures substance under the influence of quite definite forces arranges and rearranges itself in quite definite forms, so also the substantiality of the organism coming to be, under the controlling power of the ether body, or body of formative forces, orders itself in accordance with the patterns characteristic of the different structures. Just as out of the few letters of the alphabet innumerable combinations are possible, so also the metamorphosis of the organism by the etheric formative forces is unlimited. Almost every organism has begun its process of becoming under somewhat different relationships even from those of another organism born at the same time ; and it will therefore carry out its evolution according to different rhythms. For this reason the process of differentiation into individuals in the kingdoms of Nature is greater in proportion to the degree of complication of the ether body—least individualized in the plant world and most individualized in the case of man.

If one investigates the phenomena in this direction, one begins, indeed, for the first time to lift the veil from the mysteries of reproduction and heredity, as we have been able concretely to demonstrate in a simple instance from the vegetable kingdom. But we must here utter the warning that this observation of the reciprocal relation between inherited substance (species cell, germ cell) and etheric formative forces—that is, research into the structure of the physical body and the ether body in the case of reproductive living beings—serves adequately for an understanding of the process of reproduction only in the case of the vegetable kingdom, while in the animal kingdom, and most of all in the case of man, still other causes naturally share in a decisive manner in determining the formation and shaping of the organism which is in process of becoming. To this we shall revert later. (In regard to the primal forms in the case of man, see pp. 210-214.)

Shaping Forces and Primal Forms in the Development of the Embryo

In what here follows we shall proceed to a method of observation which will illustrate, by means of a few examples, the difference between the complicated embryonic processes in the animal kingdom and the simpler processes of genesis in the vegetable world. Oskar Hertwig, in his work on "Das Werden der Organismen," so full of significant facts, shows that "the investigator in all branches and all classes in the animal kingdom comes upon a gastrula stage after the fertilized egg, through a process of segmentation, has formed a group of embryonal cells. But, with the formation of an inner digesting cavity, a fundamentally important contrast is established among these cells which is foreign to the vegetable kingdom and must be designated as specifically animal. As a result of the infolding, the cells are now arranged in two separate layers, which in ontogeny are designated as the inner and the outer germ-layers, *entoderm* and *ectoderm* respectively. The function of each is different from that of the other, and is determined by its position. Those cells which are bound together into a peripheral boundary of the body, into an outer skin (ectoderm), mediate the interchange with the outer world, the action of which they experience directly because of their position. From this point of view they are rightly designated as the skin-sense layer. On the other hand, those cells which surround the primal digestive tract serve the function of nutrition; they form the intestinal-glandular layer, which, like the vascular wall of infusoria, liberate enzymes into the intestinal cavity and then reabsorb the nutritive juices thus prepared."

Thus there evolve in the first embryonic stage two germ-layers which perform, as it were, two polarically opposite functions: the outer germ-layer, the sense-functions; the inner germ-layer, the function of assimilation of substances. These germ-layers, which come into existence, as we have said, through the process of infolding, now pass through a process of evolution which differentiates them further and further from each other. Hertwig says (p. 395): "In this the contrast between form-shaping in plants and that in animals is the more sharply stamped the more it approaches toward completion. Whereas in the case of the plant, by reason of its nutrition, an evolution in outer layers takes place and is to be noted in the organs which appear outwardly—in leaves, twigs, tendril, and blossoms, as well as a many-branched system of roots—in the case of animals this occurs chiefly hidden away within the body. Underneath an outer layer, often very simple, and in connection with an outer form only slightly divided up into members, a very involved inner organization can be brought to light by means of anatomical dissection. This organization has come into existence—as we may still follow it even now in ontogenesis—through the many-times repeated unfolding and infolding of the primary inner germ-layer. Through this process, the inner surface, which at first surrounded the simple primal digestive tract, has been metamorphosed into a highly complicated system of cavities and canals, which serve for the taking up of nutriment, the secretion of various sorts of glandular juices, for reabsorption, and the like."

That to which we would here call attention most of all is the fact that the first evolutionary processes in the shaping of organs and in differentiation of these is brought about chiefly by means of unfolding and infolding. Hertwig describes this further (p. 226): "The single-celled organism can by nature metamorphose itself into a multicellular organism only through the process of cell-splitting. Therefore, in the case of all animals ontogenesis must begin with the segmentation of the egg. Out of a cell conglomerate the basic embryonic forms can come into existence only by means of a firmer co-ordination of the cells, whereupon these basic embryonic forms become the point of departure for still further formative processes. The gastrula stage must be preceded by the simpler blastula, in which the mass of the embryonic cells has experienced its first regular arrangement. The cell-layers must first be formed before new organs can take their rise out of these through different methods of growth in individual areas, either through wrinkling or through infolding." He says still further (p. 177): "It must also be borne in mind that in all processes of embryonal growth, the epithelial cells, which are crowded together in a specific space in the germ-layer and which in some cases are in a state of less active and in others of more active increase, work upon one another in a process of pressure and tension. These, therefore, bring it about that the germ-layers, which from the point of view of histology are epithelial membranes, either lie in folds in various ways, or else form sac-shaped or tubular infoldings, according to the position, form, and extension of the region embraced in this active process of growth. In this manner, according to the mechanical principle of differential growths, there come into existence organs with tubular, sac-shaped, and spherical cavities such as the nerves, the intestines, the eye and ear cavities, and the sacs which serve to enclose the embryo (amnion, chorion), or the ramified tubular systems which function as glands. There is scarcely need for any more direct demonstration of the fact that there are here factors of the highest importance for the whole formation of the embryo."

Let us now transfer the consideration away from research into the physical process of evolution over to the effect of the etheric formative forces, in order that we may understand it in its general principles, since it is the activity of the etheric forces which originate the physical process. And here we experience one of the most profound impressions of the harmonies of our cosmic system, if we remind ourselves that *the evolution of the macrocosm, of the planetary bodies, rests upon just such processes of inversion and reversal as underlie the evolution of a microcosm, a micro-organism!* The same harmonious laws lie at the basis of the evolution of the planetary bodies and the evolution of the organisms of animals and of man.

We have already shown (Chap. III, pp. 97-102) that, if one wishes to understand the structure of the body of Saturn as this has been established by modern astronomy, one must take as a foundation the fact that the etheric structure of the more highly evolved Earth represents a complete reversal of the etheric structure of Saturn : that, therefore, what is inner in the body of Saturn has become the outer in the body of the Earth, and the outer in the body of Saturn has become the inner in the Earth. Moreover, we have set forth that this reversing process repeats itself in the organism of the Earth itself, in that the etheric structure of the interior of the Earth represents a reversal of the etheric structure of the exterior (Chap. III). *We perceive, then, that this mighty macrocosmic process of differentiation, which changes the outer to the inner through the reversal of the etheric structure, and thereby alters and furthers the evolutionary conditions of each tremendous planetary organism, also reappears in the evolutionary process of the embryo as the most important factor in its evolution. What has brought to pass the genesis of the macro-organism, this brings about also the genesis of the embryo.* The coming into being of the organisms proceeds both macrocosmically and microcosmically according to the same harmonious laws ; both there and here it is the work of the etheric formative forces.

If we consider this process in the case of the evolving organism of animal and of man in individual instances, we shall discover that the unfoldings and infoldings which bring into existence the first organs come about through actions of thrust and pull, and that we can therefore follow here concretely, in detail, the alternate activities of the expansive force-group (warmth ether, light ether) or the contracting, severing force-group (chemical ether, life ether) (Chap. II) in the evolutionary process.

Of maximum evidential value for the representation here given are those experiments which have been carried out in the direction of obstructing or modifying artificially these formative processes or primal organs.* Hertwig thus describes them (p. 341): "The interference consists in the addition of limited quantities of lithium salts to sea water (to 1940 ccm. of sea water 60 ccm. of a 3·7 per cent. solution of lithium in ordinary water). As a result of this, that region of the germinal vesicle which ordinarily becomes the digestive tract, instead of now being infolded into the blastular cavity, is thrust forward to become in the opposite direction an outwardly extending process. If the lithium larvæ—as Herbst has called them because of the cause of their origin—are at a suitable time placed again in pure sea water, the intestine remains folded outward." Further on (p. 343) he says, in speaking of the so-called inhibition malformations (or deformities), "among which are to be classed the greater part of the malformations in vertebrates": "As is so appropriately expressed in the name, their peculiarity consists in the fact that, because of a checking from without, either this or that evolutionary process has not been permitted to reach its normal outcome, and by reason of its being checked a more or less notable deviation from the normal has been produced." Such inhibition malformations have been artificially produced when eggs, "instead of being placed during the first stages of segmentation in ordinary water have been put in water in which 0·6—0·7% of table salt has been dissolved. It is startling to observe what a great disturbance arises from a solution of table salt—which one is accustomed to call a physiological one because of its harmlessness—when it is introduced at the right moment in the evolutionary process. In this instance it is especially the parts of the outer germ-layer serving as the basis for the nerve substances that are acutely injured by the chemical interference." The effect was, namely, that the first stages of the third to the fifth cerebral vesicles did not draw together into a tube, but formed outwards into an open plate. We have, therefore, to do in each of the cases cited with the fact that processes which in themselves, according to the inner laws of the evolving organism, ought to have led to a contraction and infolding were transformed into a forth-thrusting and outward opening instead, and this by reason of an artificial environment containing salt! But this is thoroughly characteristic. If one recalls that the salt-forming process is induced by the action of the suctional, attracting force-group, it is clear that an organism surrounded artificially by a salt-forming process responds outwards to the drawing action of these forces, and, instead of folding a certain organ in normal manner inwards, it now turns it outwards.

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* In connection with all these problems, see the fundamental work of Dr. Hermann Poppelbaum: "Der Bildekräfteleib der Lebewesen." Stuttgart, 1924.

These transformative processes take place, not only ontogenetically, but also phylogenetically. A typical example in this matter is the arising of breathing organs for air (lungs) out of those for water (gills), which comes about through the fact that a process hitherto occurring outwards in the organism (breathing in the outer layer of the body) is removed to the interior of the organism and the corresponding organs are developed by means of dynamic infoldings and unfoldings. Hertwig thus describes this process in the case of the lungs of vertebrates (p. 403): these have "come into being out of an organ that is already present in fish (which breathe, of course, only by means of gills) and which originally has nothing to do with breathing. It is the swimming bladder which develops as a fold of the anterior section of the intestinal tube. Filled with air, which is seldom changed and contains much carbonic acid, it serves originally as an aerostatic apparatus—that is, a contrivance by means of which the bodily displacement of water may be varied. In swimming in greater depths and in rising to the upper strata of the water, it is an aid by reason of the fact that its volume can be increased or diminished by contraction or expansion of the muscular walls. Afterwards the swimming bladder is changed into lungs by means of a metamorphosis of function, which is carried out in the case of the dipnoi and the amphibians, and can in part be directly observed. . . . Through the transference of breathing into the interior of the body, the same purpose is served by other means in an even more perfect degree than through gill breathing. In one case the means is an increase of the outer layer of the skin by means of fold-formations; in the other the transformation of an originally sac-shaped cavity, developed from the intestine into an extremely complicated system of cavities. For a suitable variation of the air in this, by means of inhaling and exhaling, various other organs co-operate—groups of muscles in the walls of the chest, the diaphragm, etc.—so that the lungs in inhaling are expanded and in exhaling contracted."

How the rhythms of breathing are established, we shall set forth in Chap. XII. As is sufficiently manifest from the above examples, both the original formation and also the transformation of the organs of living creatures are the result both phylogenetically and ontogenetically of such inversion processes which, in accordance with evolutionary laws, induce the inner to become outer or the outer to become inner. The macrocosmic metamorphosis from the Saturn body to the Earth body and from the exterior of the Earth to the interior is the archetype for the microcosmic metamorphosis from a lower stage of the embryo to a higher stage. Both processes are, according to similar laws, the work of the etheric formative forces. This is a primal phenomenon in the genesis of the macrocosm and of the microcosm.

Yet here again one must not expect by any means to understand this process through any merely mechanistic interpretation, for in that case understanding will fail us in the explanation of the extraordinary differentiation between the different genera of animals and even of individual men. For, if we have understood which etheric formative force or group of forces gives the impetus to a specific evolutionary process in the organism, we have thereby recognized, to be sure, the general principle of this phenomenon ; but we need, at least in the case of man, for a full comprehension of the modifications of these general principles in individual instances, an understanding also of those influences which are exercised by the psychic element upon the action of the etheric : that is, *to what extent impulses from the side of the soul in the case of individual men induce, further, check, or hinder the activity of the etheric formative forces.*

The Sense Organs and their Formative Forces

As we have been able to understand the formation of the first organs of the organism through the activity of the etheric formative forces, so also we may now come to an understanding of the nature of the "stimulus." Hertwig says (p. 171) : "Since protoplasm is a highly excitable substance, therefore excitations may in this way be conducted from cell to cell and effects may eventually be produced in other far removed places. Since such excitations generally do not come under our observation, they belong almost entirely to the class of processes utterly unknown to us in the life of the cells." Further, he states (p. 142) : "While sensitiveness to excitation is a general characteristic of the cell in itself, with the progressive evolution of the embryo, individual cells become especially sensitive either to light or to sound, or to mechanical disturbance or to chemical substances in a gaseous or fluid state. These become, therefore, the cells of our sense-organs of sight, hearing, taste, smell, or touch. Others characterize themselves through the capacity to change their form by contraction ; these become muscle cells. Still others enter upon the service of nourishing the entire organism ; they secrete digestive juices of this or that kind ; *i.e.*, specially suited for the digestion of carbo-hydrates or albumen fat. Other cells serve for the transportation of the nutritive juices ; still others are metamorphosed for protection, support, or procreation, etc." And yet further (p. 413) : " Excitations which are taken up by the sense-cells from without and are conducted further call forth in the many-sided organism reactions in the organs affected, which lead either to a secretion or to a contraction and thus become the point of departure for a new division of labour. For this reason the cells affected undergo various differentiations.

To the question of the reality of this division of labour we shall return in discussing the siphonophoran. As we have already pointed out in Chap. V., it has been shown to be utterly impossible to understand the reality of the " stimulus " by means of the investigations which have been made in so-called " animal electricity." Research into vital phenomena and nerve-sense processes on the basis of animal electricity has done nothing toward a solution of the riddle. But the differentiation of the cells with relation to thermal, light, chemical, or other stimuli and according to their reactions through contraction or secretion, becomes intelligible to us at once if we recall (as we have already been able to perceive in the case of the plants) that they are controlled in varying degrees by the different etheric formative forces. A cell (or cell complex) controlled by warmth ether will react to a light-ether influence (" stimulus ") from without differently from the way in which a cell controlled by light ether will react. In the sensitivity of a cell or cell complex in the presence of stimuli of sound, heat, light, taste, etc., there is revealed the etheric structure of these cells, their adaptation to warmth ether, light ether, chemical ether, etc. Thus, for example, only a cell complex which is controlled in its inner structure by light ether (for example, in the eye) will rightly take up a light-ether influence from without and respond to it. Goethe therefore uttered a profound truth intuitively when he said : " The eye owes its being to the light. Out of indeterminate and auxiliary animal organs light calls forth an organ like to itself ; and thus the eye is formed by the light for light in order that thereby inner light may respond to outer light."—The different distribution of the several etheric formative forces in the ether body of an organism is the true cause of the different distribution of the corresponding sense organs. Here, indeed, we stand at the door to an understanding of how the several sense organs are formed through the varied responsive relationships between the parts of the inner organism controlled by specific etheric formative forces and the etheric influences from without. (See also Chap. XII.)

The capacity of individual organs for secretion and for contraction are likewise to be explained on the basis of the differentiation of the ether body of a specific organism. So, then, the contraction of an individual cell or a cell-complex or a whole organ always follows from the fact that one of the two phylogenetically younger etheric formative forces (chemical ether or life ether), which always act through contraction, now becomes active, either by way of an external impulse or an autonomous inner rhythm. On the contrary, a secretion—when it is not simply the resulting phenomenon from a process of contraction—is due to the fact that one of the phylogenetically older etheric formative forces (warmth ether or light ether)—which always act centrifugally—has come into action.

If we know the characters of the individual formative forces, we can from many physical processes draw conclusions regarding the special structure of the corresponding ether body of an organism. Only we must not forget that in a living organism there are also processes which are purely etheric in nature. Here lie the boundaries of a physiology which reckons only with substances. In order to be able to understand many essential physiological processes, it is necessary to have a systematic understanding of the ether body of the organism.

Since we have set forth and illustrated through phenomena which of the etheric formative forces bring about the several states of aggregation of substance, we can now also follow their activities in the ontogenetic solidification of the various members during the several stages in the development of the embryo. We thus recognize that in the process of condensing and solidifying of cell-groups—as, for example, in the change from gelatinous to fibrous tissue, to cartilage, bones, teeth, or in the three developmental stages of the vertebral column and the bony parts of the head, the force-group at work is the condensing group. Indeed we can attribute to their true causes pathological exaggerations in such processes and intervene intelligently with curative means which introduce the activities of the opposed etheric forces.

If the etheric formative force which had worked upon a specific cell-complex changes, then the state of that cell also changes. Hertwig says (p. 156) : " In the case of fully differentiated cells a change of function is only very seldom observed ; yet the individual modifications of the groups of connective tissue may pass over into one another ; cartilaginous connective tissue and collagenous tissue may arise from gelatinous tissue through the intermediate stages of embryonic cartilage and embryonic connective tissue ; and these may in turn be metamorphosed into bony substance. From tiny bodies of connective tissue fat cells may be produced. In the changing of functions on the part of cells and tissue, the original products of the protoplasmic substance are generally first destroyed. There appears a loss of differentiation, as the expression goes in pathological anatomy. Thus the basic substance of bone is softened down before ossein appears in its place; connective tissue fibre undergoes sclerosis. . . . At present, metamorphosis of function, together with its metamorphosis of cells and tissue is still a very little studied chapter of histology; yet it is evident, as it seems to me, that even in the case of fully differentiated cells *there exist alongside of the capacities already developed also others latent, which, under the necessary conditions, may become active.*" We may now say that the becoming latent or active of functions, or capacity for reaction to "stimuli," on the part of cells or cell-complexes, is the result of the becoming latent or active of the etheric formative forces appropriate to these functions or reactions. *The cause of change of functions, change of sensitivity to stimuli, change in state of aggregation in cells and tissues, of the appearance of new organs and capacities and the disappearance of others previously present—the cause of these things lies, not in the substance of the physical body, but in the metamorphosis of the ether body.*

The individual stages in the metamorphosis of the cells, cell-complexes, organs, etc., are controlled by the organism as a whole—that is, in our sense, by the whole ether body of the organism. Hertwig expresses the concrete experience thus: "Plainly the single cells here have no influence upon the ultimate result called forth by the stimulus; for this depends solely upon the systematization of structure-parts already present and prepared for action, which systematization is based upon the evolution of the whole organism and is also maintained in its condition capable of work by the whole."

If, for instance, at a certain stage in the evolution of the embryo of a child in process of development, a hitherto "latent" formative force comes into activity, or a functional change takes place in one part of the organism, then the entire organism is drawn into sympathy with this, and similar changes take place in other parts of the organism. One need only recall here the parallelism between the change of voice and puberty in man. Hertwig expresses in a very vivid fashion these correspondences between the distributions of forces in the whole living organism (p. 134): "For, if the cells, which appear through division out of the fertilized egg, do not constitute together a mere aggregation, but—as is self-evident—exert activities one upon another, and constitute themselves as a cell state into a system, there lies in their potentialities alone a source for the constant and systematic growth of a complexity. We have here to do with the universally applicable law of Nature that, when new members are introduced into a closed system of mutually inter-dependent parts, not only the system as a whole, but also the relations between all its parts, will be altered. If a new planet should enter into the system of the heavenly bodies, its influence would first of all make itself perceptible in the disturbance of the motions of the bodies nearest to it. These disturbances would then in turn bring about further changes in a constantly widening circle even till a newly established system of relationships should have been perfected." With regard to similar occurrences in the living organism he naturally makes this acknowledgment : " The objects of our research will be, of course, only such actions as either come directly within reach of our sense perceptions or else through accessory experimental means can be made perceptible to us. Now, we certainly see in the course of the evolutionary process in the development of the embryo as its parts become more and more clearly differentiated, the visible results of innumerable troops of active builders. The study of these has been for more than a hundred years the sphere of research for embryology. And who would deny with what great results the science of biology has acquainted us in the form-building in plants and animals in the most varied stages of evolution, so that it has already developed a splendid system, as a simple comparison with the science of the seventeenth century will show. And yet, in spite of such progress, we cannot conceal from ourselves that what we have thus far investigated in the occurrences in the embryo is only a very incomplete fragment of work ; since, although we have learned to understand very many ultimate results of the working of the cells, yet we have won no glimpse into the process of their work especially in the more delicate machinery of ontogenetic happenings." It is tragic to hear what one of the most distinguished investigators of our time expresses in these words. I believe that we can now state, however, on the basis of the understanding of the etheric, what here follows :—

The " active builders " in the life phenomena of the organisms are the etheric formative forces, whose specific distinctions and activities we are able to perceive in the realm of both the macro-organism and the individual, the macrocosm and the microcosm ; and the glimpse into the process of whose work and also into the embryonic occurrences we win through the concrete study of the ether body of the organism. We shall in this way pass on to an understanding of occurrences in heredity ; shall be able to investigate to what extent the organism of the new creature coming into existence is determined by the organization of its ancestors and to what extent its evolution is independent of them—that is, depends upon the impulses of its own soul. The knowledge of the etheric formative forces, and of their differentiated working, gives to us on the one hand a glimpse into the basic general laws of the macrocosmic world processes of the great planetary organisms, as also of the earth organism, and, on the other side, the corresponding harmonious laws of the tiniest micro-organism as well as of the embryo. The etheric structure determines the coming into existence and the disappearance of the macrocosm and the microcosm according to similar or complementary harmonious laws of creation. The knowledge of these two apparently polarically opposite spheres will set the two side by side in their mutual relationship through an understanding of the ether body of the organism and bring before the eyes of man combinations of which he could never have experienced anything by means of the materialistic world conception of the last century.

Animal Instinct

In order really to clarify our picture of the inner working principles, the form-shaping forces, and primal forms in organic living beings, we will consider the genesis and the life of a unique living creature which appears in great numbers in the oceans of our earth organism and has caused to biological investigators innumerable perplexities: the siphonophoran. Unfortunately, in what here follows we must limit ourselves to the observation of the most important characteristics of this unique animal, in order, to begin with, that we may enter into the essential being of the form-shaping forces and the systematization of the organisms due to these.

The siphonophoran—or, as it is also called, the siphonophoral colony—is a living being appearing in the sea which has grown up out of many individual animals organically brought together, and, indeed, in such a way that neither could the whole siphonophoran maintain life without the individual animals constituting it, nor the individual animals without the whole siphonophoran. The integration of the animal is as follows.

The whole siphonophoran is principally built up out of the following:

1. An animal which does nothing else than to form the central trunk, upon which the other animals have placed themselves; this trunk animal possesses a swimming bladder with which it keeps the whole colony *swimming and balanced*, and supports it; as we shall see, none of the other animals has this capacity.

2. One or more *motion animals*, or "medusæ," which have been called jestingly in scientific writings the "locomotives" (Haeckel). These animals can do nothing else than to keep the whole colony moving from place to place by means of a special sort of backward thrust of the sea

water, in which the colony swims, thanks to the central animal; this motion renders possible its nourishment. Yet these animals themselves have neither nutritional nor reproductive nor any other sort of organs; they can do nothing else than produce movement in one direction or another.

3. *Covering or protective* animals, which have no other function than to protect the whole against attack, to defend it; they themselves can neither eat, nor digest, nor cause motion in one direction or another; they can merely " protect."

4. *Fighting and attacking* animals, which possess " nettling threads," with nettle organs which contain poisonous points with which they can severely injure a hostile animal; but they are capable of no other activity.

5. *Eating and digesting* animals, very important colleagues of the other animals since they alone take in the nourishment for the whole animal state, work it up and digest it and conduct only the prepared nutritional substances into all the other animals, which can prepare no nourishment for themselves.

6. Creatures with *organs of sensation*. These alone possess organs of sensation which feel for the outer and inner condition of the whole animal-state and react accordingly.

7. Animals for *reproduction*—that is, sex animals. These form the male (more oblong) and female (more round) sex organs (suggesting the unique phenomena of the sidereal pendulum). These alone can provide against the dying out of the genus siphonophoran and for its reproduction.

These seven kinds of animals now stand in a unique reciprocal relationship. Scientific research has established beyond refutation that we are not here dealing throughout with one animal with seven parts, but that all these animals are complete beings each existing for itself. The single animals, when separated, can still for a short time continue alive independently; yet only for a time, since the " attacking animal " cannot maintain itself in the right position without the " equipoise animal "; it always falls over; it cannot nourish itself without the " eating animal "; cannot reproduce its kind without the " reproductive animal "; defend itself without the " protecting animal "; move without the " moving animal "; perceive the world without the " perception animal," nor orientate itself. These various animals are, therefore, compelled, if they would live, to form an animal unity! This necessity has been met by these animals when they have fixed themselves together on the trunk animal and now live in common in the water as the siphonophoran.

If one investigates the realm of will in this animal, it appears that *all the voluntary motions of the several animals are in complete agreement,* *and yet that an individual will of each animal can be clearly demonstrated.* (Haeckel.) To the injury of any animal all the others react, etc.

This unique phenomenon in the kingdom of Nature permits us to take a profound glimpse into the workshop of the living being. Haeckel, who in this field especially accomplished a great deal, was unfortunately prevented from a full understanding of the phenomenon which here lies before us because he had become so absorbed in the Darwinian theory of "adaptation" and "heredity" and "natural selection" that he lost a comprehensive vision for the contradictions in this theory at many points where it is false. In fact, the siphonophoran is a model example to cite against the mechanical theory which would trace everything back to "adaptation" and "heredity." Let one think out to a conclusion what would have had to pass phylogenetically in the case of the siphonophoran if the primal siphonophoral animal under consideration had been obliged to wait until this animal—in the course of thousands of years—had obtained by means of adaptation and heredity the instincts of reproduction, nutrition, equipoise and motion. It would have disappeared long ago before the genesis of these instincts and their organ-forming activities! This course of reflection, if pursued to a conclusion, will show clearly that the Darwinian theory cannot be maintained.

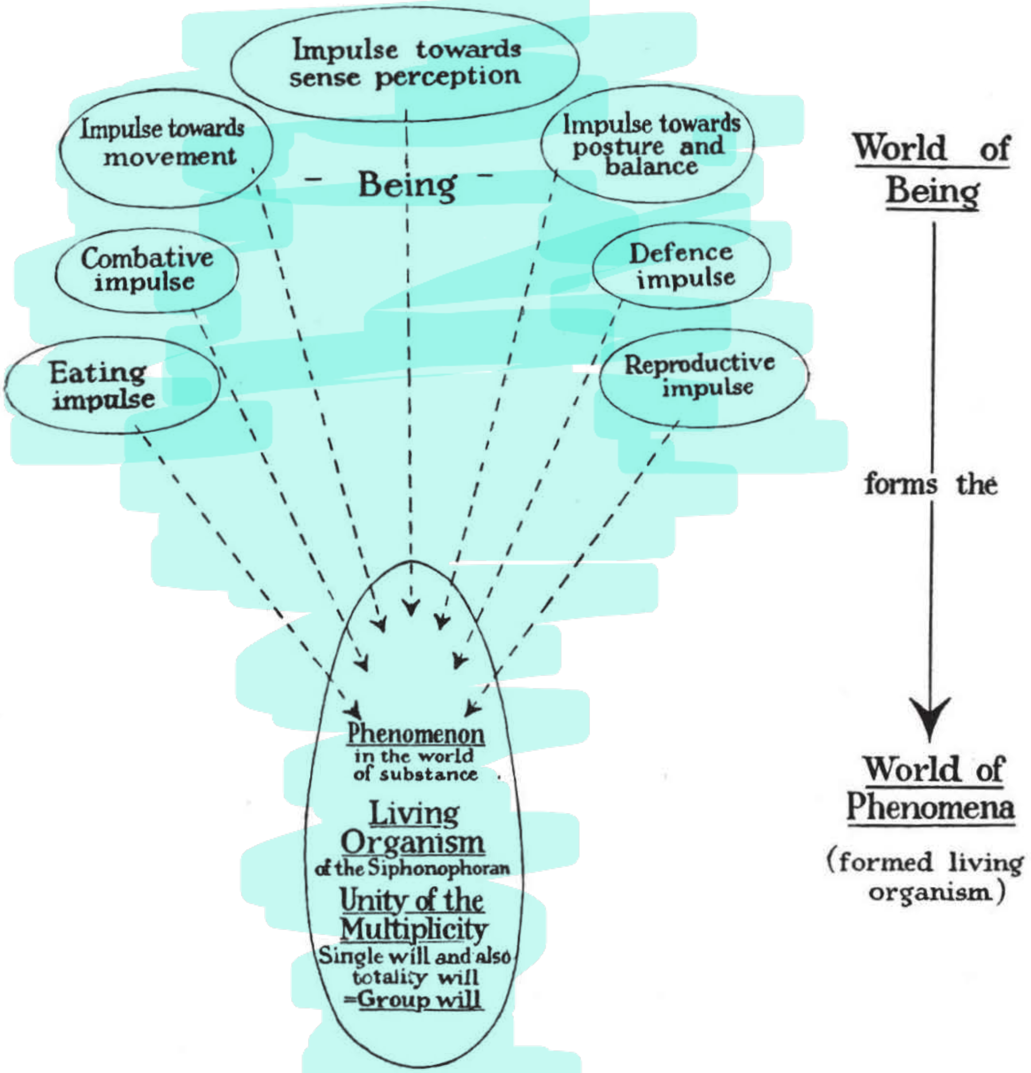
We must ask ourselves: *In what relation do the functions and instincts of the individual animals, in the case of the siphonophoral animal, stand to the whole living creature? What is primary?*

We have seen that each separate animal has its own will, and also that a collective will ensouls the whole and maintains it as a living being. *How does this unity come into existence out of the multiplicity?* Only through the fact that the will of each several animal has led them to one another for the reason that an incarnation as a living creature was impossible for each separate animal in that each separate animal being could not live alone—that is, could not maintain itself alone in a body in the water without a blending into a unity for the sake of an incarnate life, for the creation of the organism.

Whoever would maintain that the dead substance has endowed itself with life and woven all the functions of the animal by means of adaptation is talking nonsense in the very presence of the reality. *The will impulses of the several animal beings unite to form out of substance this organism in which, during their common incarnation, they may live as a blended unity.*

The living organism of the siphonophoral animal has, therefore, been shaped through the uniting of several instinct-beings into a group-will which then as a unity ensouls the living organic body.

The picture which results from this consideration is the following:



Impulse towards sense perception
Impulse towards movement
Impulse towards posture and balance
- Being -
Combative impulse
Defence impulse
Eating impulse
Reproductive impulse
Phenomenon in the world of substance
Living Organism of the Siphonophoran
Unity of the Multiplicity
Single will and also totality will =Group will
World of Being
forms the
World of Phenomena
(formed living organism)

The instinct-beings are therefore the primary, the active, the form-shaping; the living organism which unites them and, renders possible for them an incarnate life, is secondary, that which has been produced, the formed, the phenomenon.

Whoever will think in the opposite direction—as do certain Darwinians and all related to them in their mental tendency, for whom the spiritual is merely a result of the vibrations in the brain—let him only once cause a piece of sandstone, for example—that is, dead substance—to become by means of adaptation and heredity a "sand-animal" feeding itself and reproducing its kind.

Against the fundamental fallacy of the Darwinians, Hertwig says in convincing fashion (p. 640): "There are organizational relationships [redacted] Let us take only the multiplication through division of the cell grown beyond the individual mass. Since the capacity to maintain itself through feeding, growth and division is [redacted] of the cardinal questions for the evolution of human knowledge: the problem of the relationship between man and the animals.

The materialistic age has sought through most of its scientific representatives to prove that man is descended from the animals, that the human being is only an evolved animal being, the human soul only an animal soul which has ascended by means of adaptation and heredity. The religious world and some few schools of thought—which were attacked by the rest of the scientific world with all the means of a modern inquisition—have denied this theory of human evolution with the utmost determination and with full assurance of truth.

Which party gives us the truth? We will endeavour to bring this to light by means of a comparison which will be intelligible to the representative of the animal-man theory also.

Contemporary research into cosmic evolution teaches us that the sun in the course of its evolution has thrown off the other planets and their satellites; that these heavenly bodies thrown out of the central sun, which previously contained the entire solar system, have gone through a more and more altered evolution of that which happened within the central sun; that they, moreover, follow this central sun in their orbits, encircling it at various distances. The sun threw the planets out from itself, pursuing in its evolutionary passage its way through the universe. The planets thrown out from it, together with their satellites, accompany this, their source, and continue to follow it upon its journey through the universe in their various orbits.

The opinion that the sun is only a higher evolution than the planets and has arisen out of these would be considered scientifically false and illogical. But is the relation of man to the rest of Nature different from the relation of the sun to the other planets? Whoever thinks scientifically will admit that the age of materialism has here fallen into a fallacy the consequences of which are very grave. The origin of this fallacy we can explain only on the ground of the too common habit of seeking to explain all living things according to quantitative and mechanical laws after the manner of an inevitable mechanical evolution.

In considering the forming of the living organism, we have been able to perceive that the spiritual, the formative, the substance-creating and form-shaping, the creative, is primary; that it was before any beginning and also still is. That the living organism, on the other hand, represents the secondary, the shaped, that formed by the formative forces, the object of the creating, the created. The world of substance, woven through by spirit, and the spiritual world working through our phenomenal world, are going through an evolution, in which we all share. But just as the sun cast the planets out from itself in this process of the evolution of the cosmic system,—left them behind in order that they, encircling the sun, might follow it—*so also the instinct beings and their creations in the phenomenal world, the animals, are thrown out and remain behind in the evolutionary course of the human being, surrounding him at lower stages.*

Whoever maintains that man is a product of the higher evolution of the animal, is uttering a contradiction similar to that of the man who would say that the sun is a product of the evolution of the planets and their satellites.

Whoever, on the other hand, says that the human being in the course of his evolution cast out from himself those lower instinct beings* and formative forces which could not share in his evolutionary course, which remained behind him, just as the sun threw the planets out from itself and let them grow cold, such a man speaks not only intelligently but also speaks the truth, in accordance with the spirit of Genesis.

But not only is there a great distinction in world-conceptions but also a decisive turning point in human evolution, a boundary line according as we say that *man is a more highly evolved animal,* or that *the instinct beings and their organic creations the animals are, as it were, a hardened residue of lower portions of being which the self-evolving human being cast out from himself and left behind in his environment.*

Such an origin of humanity is taught by Anthroposophy, in contrast with the conception other schools of thought hold in regard to the human being striving for the truth. Research into the living, into the organic will at this point reach its line of demarcation.

Before we pass on to the consideration of the human being and his living organism, we will endeavour to grasp comprehensively what distinguishes the kingdoms of Nature.

What chiefly distinguishes man from the animals? This question carries its own answer. We men differentiate ourselves from our outer world and inner world by means of thought, in that we distinguish between true and false, understanding and error, knowledge and belief, upward evolution and decadence: in that we seek to place our ego in conscious relationship with the realities of the phenomenal world on the one hand and the world of pure spirit on the other; in that we endeavour so to extend knowledge by means of thought that at the end of our way the all as reality becomes one with the all embraced by our ego through thought, becomes identical with it. This ego evolving itself in a striving of thought and action toward its goal is the sole true designation of man, that which distinguishes him from the animal.

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* For details, see Dr. H. Poppelbaum: "Mensch und Tier." Basel, 1928. English Edition, "Man and Animal." London, 1931.

The animal also certainly has a soul, but no ego reflecting concerning itself and its action in striving toward a goal. The soul of the animal is clearly determined in its content through the sum total of all the instincts which, as has been described, through a common working together, through a group-will, create for themselves the organism without which they could not live in the phenomenal world. But this group-will is differently constituted in the case of the different sorts of animals. If, for instance, the group-will has the configuration which we have previously described, then there arises the siphonophoral animal. It will naturally be of a different sort when, for instance, the species " lion " comes into existence ; different when the " eagle " kind arises ; still other when the species " cow " arises ; it will contain in one instance the instinct beings which desire to live as " lions," in another case those which will live as " eagles," or such as will live as " cows." But for all animals of the " lion " kind this group-soul is the same ; for all of the " eagle " kind the same ; for all of the " cow " kind the same. It begets in that special configuration which creates for it the organism of the lion, and naturally never that of the eagle ; but it is always the same for the lion species, the lion kind.

Here lies the distinction :—The animal soul is a group-soul, which is the same for all animals of the same species, created by it ; it distinguishes itself only from the group-souls of the other species of animals or animal kinds. The single animal has no ego, which, reflecting about itself, separates itself from the outer world, in order to set itself over against this world through thinking and knowing, as a separate entity, in order through knowing to master all the rest of the world instead of being mastered by it. This conscious separation of the self is possible to man alone, the individual human soul, the human ego. That in man which still resembles a group-soul is for that reason a residue in him, and belongs to the animal kingdom ! We shall not here discuss the question how great this residue often is even now. But what distinguishes man as such, separates him fundamentally from the animal, is the fact that he is endowed with that ego through which the individual soul, conscious and striving toward its goal, will in the course of evolution gradually be freed from the residue pertaining to the group-souls and animal nature. It is for this reason that only the human being, and he also only when his conduct is determined entirely by the ego, is free ; for this reason he alone is as an individual immortal, imperishable. For this ego creates for itself an incarnation as a transitional stage in its passage through the phenomenal world. It is not the task of this book to enter further into these realities. The " Philosophie der Freiheit "* and other writings of Dr. Rudolf Steiner teach these things profoundly, as they are.

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* Translated under the title " The Philosophy of Spiritual Activity." London, 1922.

Here we shall only indicate what integral parts of the living organism appear in the several kingdoms of Nature. The group-soul of the animal is descended, as we have seen in the case of the siphonophoran from a desire-world, a world of instinct-beings, which create in the living organism of the animal, or in the species of animals, their work-tools, in order to be able to incarnate themselves in the phenomenal world. This group-soul can be the object of research in the phenomenal world only in its working-tools—the single animals, and, since it is a closed complex, it can be given its designation ; just as we give the designation " physical body " to the physical and substantial phenomena, or as we give the designation " ether body " to the totality of etheric formative forces working and shaping in these individual organisms. It has now become customary to apply the designation " astral body " to these closed soul-units formed out of the instinct-world in specific living beings. Whoever, by reason of a mechanical and materialistic habit of thought conceives of some sort of substantial unity in the case of this designation " body " as applied to these non-physical members of being has himself to blame for the error. The term " body " here signifies only a combination of all the principles present—that is, active—in a specific organism :—

" Physical body " means the sum of all the substances belonging at any moment to this organism (and these of course also change).

" Ether body " means the etheric formative forces working in this living organism in its shaping and its life manifestations.

" Astral body " means the combination of the instincts, desires, passions working and shaping in this specific organism—that is, the sum of soul-impulses.

The designation " astral body " has been chosen for the reason that an earlier intuitive knowledge, which passed beyond research in the lifeless, in the physically perceptible and the substantial, placed this member of the animal's being in relationship with the " astra," with the stars, and therefore spoke of an " animal circle "* in the heavens, as of a sphere of the archetypes of the creation and designated this with different animal symbols ; a thing which we have now taken over automatically and without understanding, as in another instance to which we have referred, we have taken over from Kepler only the dead skeleton of his three laws, and not the spiritual knowledge to which these three laws belong inseparably and out of which they sprang.

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* German *Tierkreis*, the zodiacal circle.

Kepler says in his " Harmonices Mundi " : " Thus shines in the soul of the earth also a copy of the " animal circle " as indeed of the whole visible starry firmament, a bond of sympathy between the heavens and the earth."

Whoever still prefers to see in the earth only a mass of substance moving itself unintelligibly through the dead cosmos, after the manner of a dynamo-machine, can at least accept the term astral body for the soul-element in the animal as a permissible designation for this member of the animal-being for the sake of a mutual understanding; but that he must soon mark the end of his knowledge with the word " ignorabimus " we have already shown.

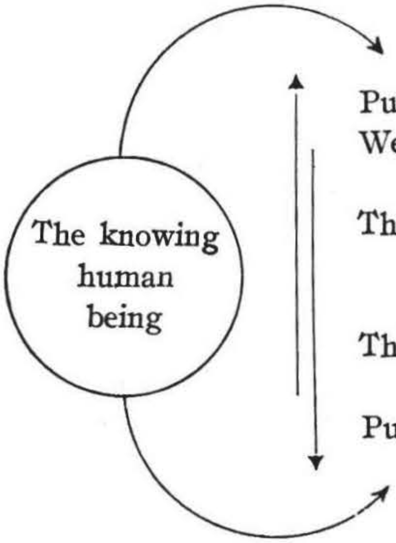
If we now consider the kingdoms of Nature with reference to the question how the several members of being appear in these kingdoms, then we shall find the following:

Of the members of being,
Man possesses : Ego, astral body, ether body, physical body.
The animal possesses : only astral body, ether body, physical body.
The plant possesses : only ether body, physical body.
The mineral possesses : only physical body.

We have at the beginning of this chapter traced the manner in which substance as such undergoes a process of individualization in that it progresses from the denial of the laws of the earth in the case of gas to a one-sided assumption of form through the effect of the earth-organism in the liquid, and finally in the solid body enters into a state which, taking fully into itself the laws of the earth organism, has become individualized in itself.

There is inside of the earth organism, moreover, an ascent in this course of evolution in substance ; scientifically it is called the polarization figures. In speaking of this Dr. Steiner has warned us that the co-operation of light in connection with this phenomenon is not the most essential element, for light only mediates to us the possibility to perceive this phenomenon as such. For an exact observation of the fact, the essential thing is the truth that here two individual substance-figures, two substance-individualities, merge into a new unity, in that two hitherto individual forms now penetrate each other and through the mediation of the same light common to both give a new closed picture which shows the two blended individualities as a single unity.

Let us now recall how we can follow the etheric formative forces in their work in the different fields, how they weave and create this picture which we experience as our phenomenal world, as the shaped and coloured substance-world. We can, then, look comprehensively upon the activity of the etheric formative forces, as it were, as a " picture-weaving activity" and recognize the result of their activity, perceptible to our senses, the phenomenal world, the shaped and coloured substance world, as the "woven picture." In the third place we experience an ascent in this world content when two created picture-forms on their part become perceptible to us as a new unity through their unification, their blending. The world, then, given partly to the thinking understanding and in part to the sense perception of man, closes itself for him as a living spiritual being in the following circle:



Pure being.
Weaving, picture-making activity (etheric formative forces).
The woven picture (the content of perception, the phenomenal world of colour and form).
The blending of several individual pictures to a new unity.
Pure being.

The ego of the understanding human being, however, strives without rest toward that far goal where the all which the thinking understanding of the human being embraces will be identical, will be one, with the all as reality.

Chapter XII

MAN AND MAN'S ORGANISM

The statue of the goddess at Sais in Egypt :

> " I am she who was, who am, and who shall be ; my veil no mortal has lifted."

Novalis, Paralypomena :

> " To one it chanced ; he raised the veil of the goddess at Sais. But what did he see ? He saw—wonder of wonders—himself ! "

Novalis, The Disciples at Sais :

> " And if no mortal, according to that inscription there, lifts the veil, then we must seek to become immortal ; whoever does not will to lift it is no true disciple of Sais."

Leonardo da Vinci, in his Anatomy :

> " And man is the model of the whole world."

Man is a microcosm, his organism a copy of that great world organism, the macrocosm. Whoever will know the realities which distinguish living men from corpses of men, must look upon the living organism, not only as a closed unity, but most of all from this point of view : how in it also the same etheric formative forces live which bring forth the organic processes and vital phenomena in the rest of the cosmos external to man ; most of all he must learn to understand the reciprocal relationship which exists between the great rhythms of the etheric environing world and the human inner world ; and he must also discover how the living cosmic architecture through which these formative forces have produced the evolution of the macrocosm, the genesis and maintenance of the earth organism, finally reaches in the architecture of the human organism a degree of completion which not only places and maintains man in a state of harmony with the macrocosmic process, but in him strives for a higher ascent beyond that already reached in the preceding evolution.

The human body is also to be understood as an organism, and not abstractly or by mere mechanical computations. Only, because natural science has undertaken to carry over into the investigation of organic processes the thoughts and methods tested on dead matter, it has been forced hitherto to pause at the threshold of an understanding of the phenomena of life in regard to which, as Lenard says out of such bitter experience: "the investigator of Nature, with his conceptions, which elsewhere have guided him so remarkably, has nothing to say."

A turning point in this resignation in regard to understanding is marked by that teaching concerning the three-fold system of the human organism, as this was initiated by Dr. Rudolf Steiner in his work "Von Seelenrätseln,"* and as it has since been further developed by him in the most concrete details as the method for research into organisms. Since here we are to consider the world process chiefly from the point of view of the etheric, this teaching concerning the three-fold system of the human organism can be introduced only so far as is practicable within these limits; but the investigator is referred for its more thorough discussion, especially to the remarkably comprehensive dissertation of E. Kolisko, M.D., in the monthly review "Die Drei" (August, 1921), and elsewhere.

In considering the earth-organism, we have seen that the etheric formative forces in this are systematized in a polarity in such a way that at one pole the warmth ether is chiefly active and at the other pole the life ether, while between the two poles the chemical ether and light ether act in rhythmical processes. A similar polarity now shows itself in the activities of the etheric formative forces in the architecture and vital phenomena of the human organism. Indeed, we have been able to show—going beyond the demand of the investigators in radio-activity, Professors St. Meyer and E. von Schweidler—that the totality of vital phenomena in the human body will be understood in accordance with reality only when we perceive the etheric forces at work within the "physical body"—which includes only inanimate substances—and when we conceive the sum total of the etheric formative forces belonging at any time to a certain human organism as the "ether body." It may now easily be shown that, both phylogenetically and also ontogenetically, the genesis of the human organism rests upon a polaric grouping of the etheric formative forces, which lie at the basis of the structure of the "ether body" of the present-day man, and also have as their inevitable natural result the present structure of the human physical body.

The "ether body" of man, which shapes and maintains his physical organism, has therefore the following ground-structure :—

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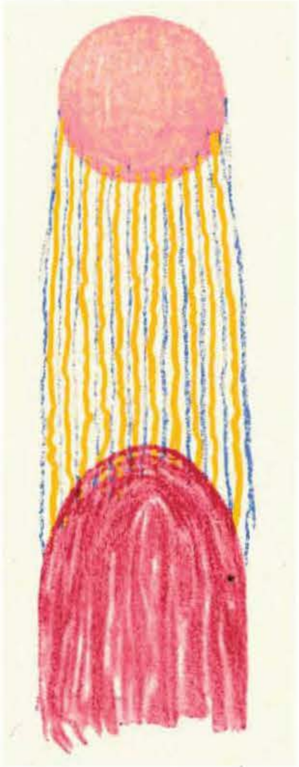
* Berlin, 1921.


Consciousness pole, mineralizing tendency.
Life ether, Pole of the " cold flame."
Rhythm-producing tendency.
Light ether and Chemical ether in rhythmical alternation.
Metabolic pole, centre of the processes of combustion.
Warmth ether, Pole of the " warm flame."

Thus we see chiefly the formative forces of life ether at the upper pole and at the lower pole chiefly that of warmth ether ; between the two, light ether and chemical ether in rhythmical alternation. Now we shall consider in detail the physical body as a result of this etheric structure. If one investigates the physical body in its organic systematization, we shall be convinced of the presence of three systems embraced within this organism : *the nerve-sense system, the rhythmic system,* and the *metabolic-limb system.* The nerve-sense system, of course, extends throughout the whole body, but it has its chief starting point and organ in the human head ; there in the brain is the focus of the waking, conscious soul-life ; there are centralized the leading sense organs which characterize " man." This pole—which may, therefore, be called also the consciousness-pole of the human organism—is characterized, however, also by the fact that at this pole has occurred the greatest accumulation of mineral substance within the organism. In the bony mass of the head the organism has assembled together a maximum of solid substance and a minimum of soft substance—that is, of movable, changeable substance—in a fashion to be found in no other part of the organism. The human head, the consciousness-pole of the organism, is therefore at the same time the pole of the highest concentration of solid mineral substance.

Let us now recall how we have been able to follow the formative forces of the life ether within the earth-organism, how it brought about the formation and centralization of solid substance in the mineral spheres of the earth, and therefore produced the highest state of substance yet reached phylogenetically, and how, on the other hand, it worked as a free force or current, not bound up with substance within the earth organism in alternate relationship with the phenomena of consciousness. In an analogous manner the life ether now manifests itself in the human organism in a similar activity. That is, in the upper pole, the human head, where it has its focus, it reveals its mineralizing tendency in the heightened accumulation of bony substance, and on the other hand in the fact that at this pole there is also centralized the most important organ for the activity of human consciousness. (Diagram, p. 197.)

The opposite pole within the human organism is the metabolic pole, which—although this again naturally works through the whole organism—has its focal point in the lower parts of the organism in that the stomach and the associated digestive and eliminatory organs are the chief agents of the metabolic process. Now the fact that these metabolic processes are chiefly processes of combustion, shows us that at this lower pole the etheric force of warmth ether is predominantly active. (Diagram, p. 197.)

Between the two poles—the upper pole, where the life ether shows its mineralizing tendency in the building of the hard bony structure of the head, and the lower pole, where the combustion processes of warmth ether have their most important point of focus—there lies in the middle the rhythmical system of the human organism, as manifested in the breathing and the circulatory process, which has created its central organs in the lungs and the heart, whose rhythms we shall find to be caused by the chemical ether and light ether.

The inner systematization of the human organization reveals a still further parallel with the phenomena within the earth organism: the polarity between the " cold flame " and the " warm flame." In considering the theory of light (Chap. VII) we have learned to recognize two sorts of light: " pure light " of which the radiation into the earth organism from the cosmos and a few phenomena within the earth organism are characteristic examples (phosphorus, for instance) ; and " heat light," which is bound up with the process of combustion—that is, with the activity of warmth ether—and which through its relationship to the substance-world (O_2 instead of O_3) stands in polaric opposition to cosmic and terrestrial pure light. This polarity between pure light and heat light is characteristic of the human organism even as of the earth organism: *at the metabolic pole, which mediates our relationship with the substances* *of the earth organism, we find the warm flame; at the consciousness pole, the cold flame.*

By the terms *cold* and *warm flame* is indicated primarily that at the upper pole of man the ether body develops a force-activity of the kind which meets us elsewhere in pure light; and at the lower pole, on the contrary, predominantly such a force-activity as meets us in heat light in the case of other phenomena in the earth-organism. Moreover, at the basis of this polarity lie still other realities whose explanation here would lead us too far afield. (Meister Eckhart says: "Man has the image of God in his upper branch, which there shines without intermission.")

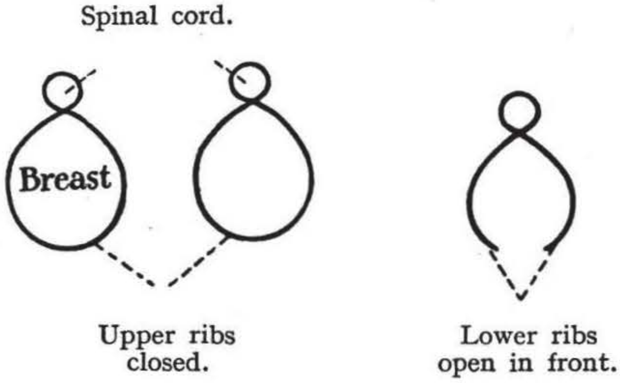
We have seen in the preceding chapter that the evolution of the germ begins with a polarity of functions: that is, a separation into two germ-layers, wherefrom the sense instruments are developed out of the outer germ-layer and the metabolic organs out of the inner layer. We have seen further, when considering the process of heredity, and in explaining the primal predisposition, the "species cell" or "germ cell," that it is the ether body which determines the *plan* and brings it to accomplishment in the evolving organism. Just as the functions of the germ-layers are polarically systematized in the embryonic process, so also the functions in the growing organism are centralized at two poles: the consciousness pole in the head, which constitutes the centre of the nerve-sense processes and also the chief field of action of life ether ("cold flame"); and on the other hand the metabolic pole in the lower part of man, the chief field of action of warmth ether ("warm flame"). If one thus follows the metamorphosis of the evolving organism through the organ-building forces of the ether body consistently from the embryonic state to the completely formed organism, one will understand the living dynamics of the formative forces. One then understands the reality of the phenomena of life.

Since this polarity between warm and cold flames in the human organism is of decisive importance for an essential understanding of the phenomena of life and the phenomena of consciousness in this organism, it must in future be placed at the very basis of biological research, even though a complete explanation of all the depths of its nature is not possible in our day.

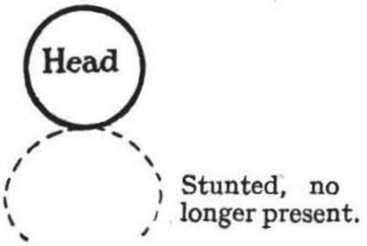
If we now follow in detail the activities of the etheric formative forces within the human organism, we get the following picture, which will be completely confirmed by the findings of modern anatomy.

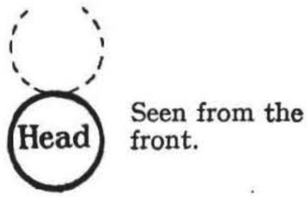
When we find the life ether active in the solidifying and mineralizing tendency in the head, the light ether and the chemical ether in their rhythmic action in the element of air (breathing) and of the liquid (circulation of the blood) in the rhythmic system, and the warmth ether in the processes of combustion in the metabolic system, we are dealing—as we have said—with the focal points of their intensified activity within the three-fold system of the human organism, the structure of which we have already seen sketched in the polaric functions of the germ-layers. Naturally, however, the several etheric formative forces appear in lesser concentration also in the other parts of the human organism. The structure of the bony system of man, for example, gives weighty evidence of this fact.

If we consider the bony framework, as it has come into existence through solidifying out of organic states, this will be seen to be at its maximum distribution in the head, appearing in lesser degree in the middle system of spine and ribs, while finally in the lower system where there is the greatest proportion of soft substance, it is much reduced and withdrawn inwards. It is interesting for one who observes vitally and organically to determine how in the bony framework the figure of the lemniscate, the figure 8, appears in the greatest number of variations. This is most conspicuous in the middle system, where the bony framework at the back very narrowly surrounds the spinal cord while in the forward part it embraces the breast and the lungs in wider arcs in the form of the ribs, so that the bony structure as a whole describes the figure 8, the lemniscate.



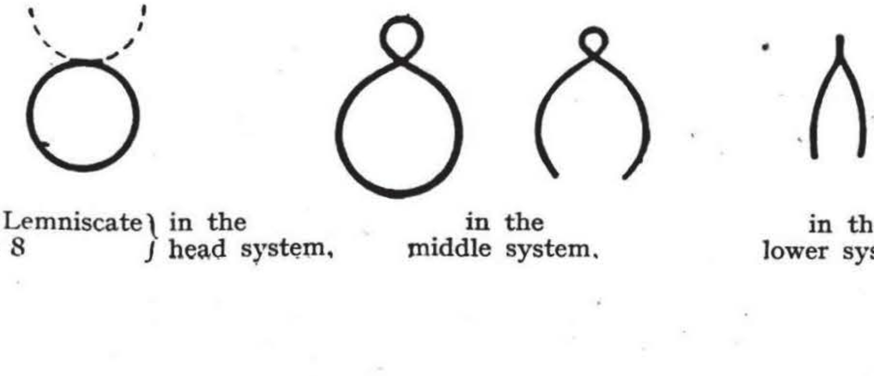
If we follow the metamorphosis of this form—in the sense of Goethe—toward the upper and the lower pole, we shall discover a new picture. Dr. Eugen Kolisko describes this vividly as follows : " If we imagine the casing of the spinal nervous system, the rear arc of the lemniscate, or figure 8, to be widened when its content, the spinal cord, is puffed up and becomes the brain, there then appears the spheric-globular form of the skull. In the head, the bony framework is shaped according to such a spherical principle. It is the casing of the nervous system. In this way also, it comes out to the external layer, pressing away the muscle and touching the skin. It becomes an external bony coat of mail instead of a supporting system (the facial system is really only appended to the skull). On the other hand the forward part of the figure 8 is eliminated. The rear portion presses toward the front in building itself out. The lemniscate becomes spherical."





(In the antlers and horns of many animals we still see residues of the forward open arc of the 8 which is fully formed in the case of man only in the middle system in the ribs, and on the contrary is not present in the head.)

" If we descend lower, the ribs curve more and more ; the arc formed by them becomes wider and wider, till it can no longer close on itself ; what it embraces in breadth it loses in length, so that the ribs no longer reach the breast-bone ; they spread apart and point more downwards. The rear part of the arc, instead of expanding as happened above, diminishes, together with its content the spinal cord, which becomes thinner and thinner. The continuation of the spinal cord goes into the lower extremities in whose radial direction—perpendicular to the earth—the whole skeleton is now turned. Here the rear bow has disappeared ; the forward bow has turned down about 90 degrees and placed itself in the direction of gravitation. This static-dynamic principle may be called the radial principal. The bony framework has withdrawn itself inward ; it serves altogether the function of support ; the muscles surround it and it is imbedded in the innermost part of the life-permeated fabric ; in brief it is in a polaric relationship to the manner in which it manifested itself in the dome of the skull. Thus the bony system is in the one case the polaric opposite of what it is in the other. Thus in such an organic system we see the three-fold systematization of man confirmed in its three sorts of shape."



The Lemniscate } in the head system, The 8 } in the head system, in the middle system, in the lower system.

In order that we may never forget that man, as a being living within the general laws of the macrocosm, is shaped in his organism by the same etheric formative forces which are also active in the organic structure of the cosmos, let us recall here that the forms of the motions of the various planets actually shape lemniscates. Dr. Rudolf Steiner has pointed out these relationships in detail in one of his courses of scientific lectures. Here again—as in the placement of the leaves on the main axis of the plant (p. 165)—the understanding of the human organism will be enriched by drawing upon the planetary etheric spheres (Chap. III) through an understanding and comparison of the cosmic processes, and *vice versa.*

The forms which are described by the planetary motions in the ether ocean of the macrocosm are obvious lemniscates or variations of this basic form. Professor J. Plassmann gives in his " Himmelskunde "* the following geometrical representation of the planetary orbits, wherein, as he says (p. 153) : " The heliocentric system of Copernicus represents the apparent courses of the planets just as well as does the geocentric system named after Ptolemy."

All planetary orbits describe variations of the basic form of the lemniscate.

In the etheric spheres in which these macrocosmic, planetary motions have taken place has occurred likewise the genesis of the human organism and this has, therefore, maintained its basic form stamped by the laws of that ether ocean in which it has evolved.

Let us now proceed from the mineral bony system, which has reached its strongest development in the human head, to the rhythmic system of breathing, blood circulation, etc. Here we enter upon territory entirely new to scientific research, since an explanation of the true causes of the rhythms of breathing and of blood circulation has hitherto been admittedly impossible, as these processes can be explained thoroughly only by means of the nature of the etheric—that is, through the activity of the " ether body " of the earth organism and the human organism. The exact observation of the most important phenomena within the earth organism has given us as an aid toward a view of this matter the following material. The great rhythms of the earth organism—as these come to expression in the most diverse spheres in the " double wave of the barometric pressure " and in the rising and falling of water in the vegetable world, in a rhythmic alternation of potential gradient, induction, emanation, etc.—we have been able to explain as the results of a rhythmic breathing process of the earth organism (Chap. III), whereby, chiefly in the lower strata of the atmosphere, chemical ether and light ether act reciprocally with one another. We were able to show, further, that

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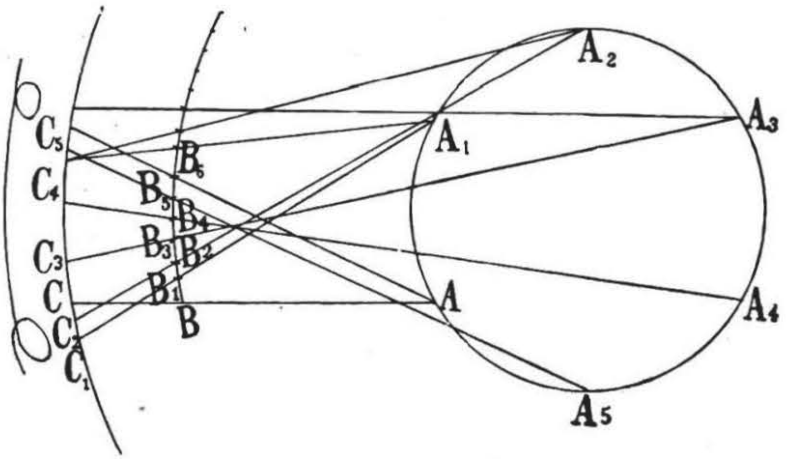
* Berlin, 1924.

Geometric representation of the Planetary Orbits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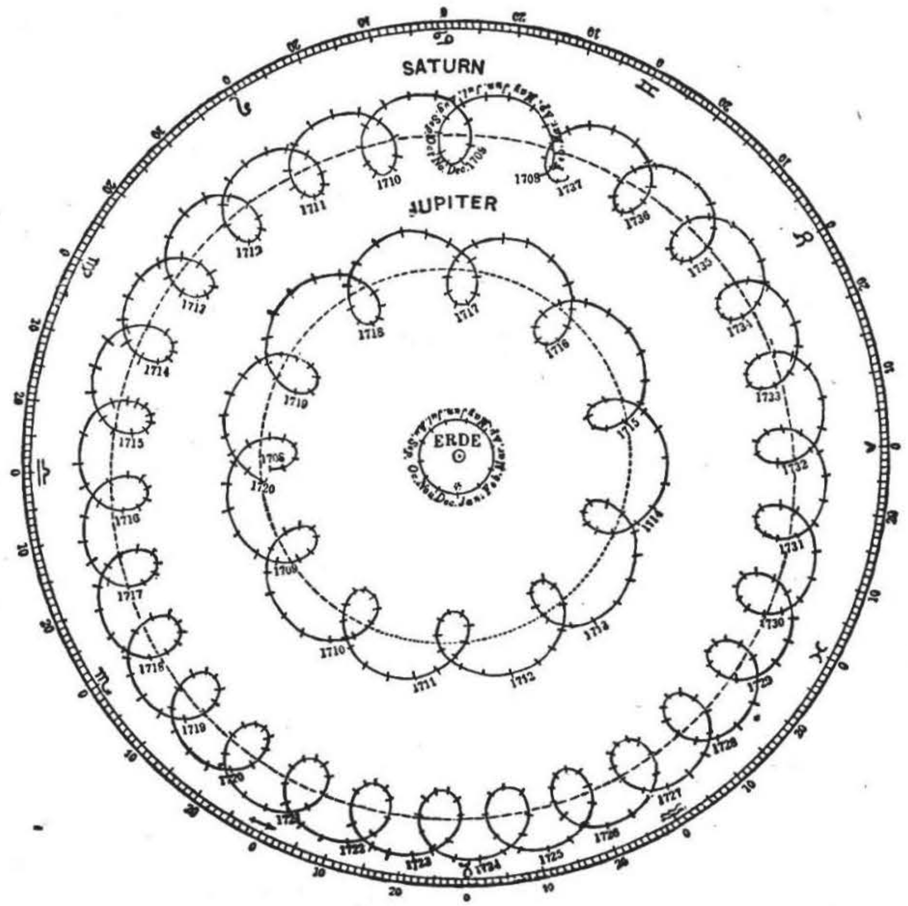
C5

Movement in the Copernican system viewed geometrically (after Plassmann).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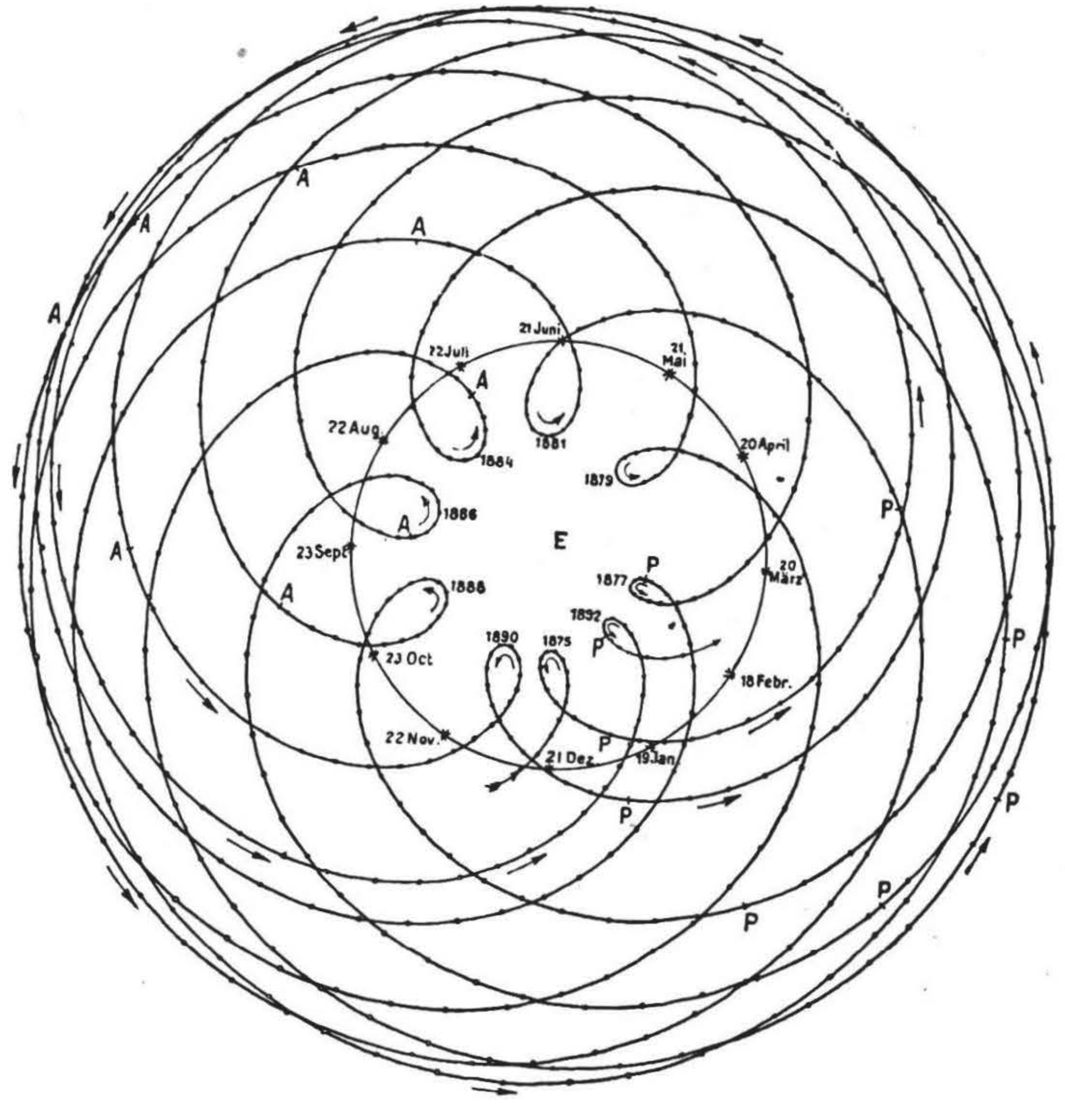
Epicyclical motion of Jupiter and Saturn (after Plassmann).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Epicyclical motion of Mars (after Plassmann).

the normal breathing of the human organism stands in a certain time-ratio to the breathing of the earth-organism and to the macrocosmic rhythms; that is, that 25,920 normal breaths of a man equal one breath of the earth-organism, and a corresponding number of years is required for the passage of the sun at the spring solstice through the signs of the zodiac. If we consider more closely these two forces which stand in rhythmic mutual interaction, we discover that the light ether is an expanding force, the chemical ether a contracting force, as we have been able to confirm by various phenomena (Chap. II). Through this fact, the process of human breathing is easily explained: The expansion and the contraction of the human lungs, and so also the *rhythmic inhaling and exhaling of air, are a result of the rhythmic alternate action* *of an expanding and a contracting etheric formative force of the human ether body : the light ether and the chemical ether.* (Diagram, p. 197.)

Let us here introduce into the explanation two further phenomena to which we have already referred : the triangular (light ether) and beside it the hemispherical (chemical ether) form of the condensation from the human breath (Diagram, p. 159), and the analogous form-shaping in the light-ether sphere and chemical-ether sphere of the earth organism (hail, cloud condensation, etc. : diagram, p. 158). And let us recall what has been said in regard to the genesis of the phenomenon of tone (Chap. IX) : that is, that audible tone arises from a conflict between light ether and chemical ether for a condensing and rarefication of substance, the air. The world of tone which the living human organism produces in singing and speaking requires the organs of the larynx and the lungs for its production, and belongs therefore to the rhythmical system of man, and thus to the same part of his ether body in which light ether and chemical ether, which produce tone phenomena, are active.

One of the distinctions in the kingdom of Nature which relates to the deepest being of things in the cosmos is that between *living creatures which can produce tone from their inner being and those which cannot produce any such tone.* Thus the mineral kingdom, the vegetable kingdom, and most of the cold-blooded animals are alike in the incapacity to give forth any tone from the inner being ; while, on the contrary, the warm-blooded animals and man can give forth such tones from within. It is speech, however, more than anything else which places man at the apex of the visible kingdoms of Nature, for speech has become for him of the most decisive import for the formation of his concepts and thus for the evolution of consciousness.

Our words, which resound from within ourselves, which we speak, lie at the basis of our thoughts, and they are the form of expression for our thoughts. These expressive forms for our thoughts fill space, in that they propagate their waves by means of the sound ether in the space surrounding us. Now only one who cannot think courageously to a conclusion will refuse to acknowledge that it is a matter of importance for the evolution of the cosmos that the etheric structure of the space surrounding us is set in vibration by our words expressing our thoughts, in which process an inner real forms an outer—that it is a fact of far-reaching import that in the spatial sphere, which we know to be filled with world ether, living beings are present capable of sending forth individual sound vibrations from within themselves into this space-filling world ether, modifying it thereby. A vastly different condition would exist if there were no such living being. The horizon of our understanding in reference to these things is, unfortunately, at present very restricted. Yet ancient schools of mystery in the Orient and the Occident knew what tremendous force and action dwelt in certain words and combinations of words and they made use of this knowledge. In our time of abstract intellectualism the knowledge of the action of these sounds upon the associated and surrounding worlds has been lost, because we have lost inner contact with the true being of speech, of the " word " itself, as this still dwelt in primal speech. This fact rests upon the deepest necessities of human evolution, but epochs which shall follow this materialistic age will be able, nay compelled, to find again the understanding of the being of the " word " and its action if they shall desire to press through in their research to the beginning of the world, on the one hand, and to its goal and the end of the world on the other. Out of an understanding of these relationships filled with wisdom, the Gospel of St. John begins with the expression : " In the beginning was the word. . . ."

Something real vibrates mutually in the ether body of a fellow man when we speak to him, and this acts upon him throughout his ether body and therefore also in his physical organism ! It is not always merely the abstract " content " of words spoken to us which injures us or vitalizes us.

A word—that is, a certain combination of vowels, consonants, and tones—which streams out from our organs of speech does not merely impress our ear as a sensation of sound, or our thought-world according to its content ; but, since in the organism of the one speaking it owes its genesis to a certain combination of etheric formative forces which shape the sounding air to certain air-forms, therefore it calls forth in the ether body of the hearer a real effect, which may be, according to the nature of the spoken word, either transient or lasting, sound or unsound, warming or chilling, injuring or vitalizing, upbuilding or destroying. Since the word-sound through the air is made up of spiritual-soul element (sense-content), etheric element (formative force), and physical element (air), therefore its effect upon a fellow man is also threefold, and it reaches not merely the sense organ, the ear, but by means of the ether body also the whole organism of the man. In the spoken word the united action of the spiritual-real, the etheric formative forces, and substance is complete.

In music this very delicately modulated but very strong action upon our etheric organism, our inner tone world, and the harmony of our soul life is already to a certain extent becoming clear. The influence of music reveals to us the soul-life of man in this close contact with the etheric and through this medium with the world of substance and, therefore, with the physical human body. Thus the deep-reaching influence of music may extend even into the substance of the physical body.

Music created on the basis of a true knowledge of the ether may exert healing or disease-producing effects upon human bodies. In this matter there are weighty problems for psychology, therapy, and art. We have already referred to the mutual relationship between tone and the altering of substance in discussing Chladni's sound-figures (Chap. IX). Many progressive investigators might soon penetrate to the true nature of tone, or speech, of the " word," through an understanding of the etheric. (In regard to the " breaking of the voice " see also p. 220.)

But the breath, and speech, which is intimately connected with breath, are only one part of the rhythmic system in the human organism. For the motion-process in the blood circulation also, the causes are to be found chiefly in the etheric processes of this rhythmic system. Views hitherto maintained concerning these things have sought for the initiation of the motion of the blood in the idea that the heart, after the manner of a mechanical pump, performs motions and thereby squirts the blood, as it were, into the arteries, though by such a conception we have not been able to discover concretely what then induces the heart in turn to perform such motions. The same thing is happening to research in this matter as in the case of the views concerning the pressure of osmosis in plants (Chap. III). For a certain time it was believed that this phenomenon could be explained on the basis of merely physical processes, but it was soon observed that in reality these physical processes were not the causes of these vital phenomena and did not correspond with the work done either in strength or in character. In the case of the blood circulation also, as in that of the rising and falling of water in the trees, etc., it is the ether body of the earth organism and of the human organism respectively which induces these phenomena of motion and of life; in the case of the blood circulation also it is the etheric formative forces of the rhythmic system, light ether and chemical ether, which bring about this rhythmic circulation of the blood. To what extent the blood circulation is induced and determined by the etheric " vital current " streaming during the course of each day through the human organism we shall later indicate.

The organ of the heart—which is no mechanical pump, but a quite different and far more important organ—cannot possibly be understood without a consideration of the genesis, the coming into existence, of this organ. We are then brought to the understanding that the heart did not induce the circulation of the blood, but on the contrary the blood circulation gave the impulse to the formation of its central organ, the heart; for we find that both phylogenetically and ontogenetically there is proof that the blood circulation existed before the organ of the heart was formed. The organ of the heart is, as it were, a highly metamorphosed blood vessel which was broadened and shaped into a complicated structure and in this way made the agent of certain new functions for the motion of the blood in man and what is therewith connected ; just as the head—in the sense used by Goethe—is a metamorphosed vertebra which has been shaped to more complicated form by the impulses lying at the basis of these processes. By means of such a metamorphosis, which in the blood system led from the circulation of the blood to the formation of the organ of the heart, and in the nervous system led from the formation of the spinal cord to the formation of the brain—by such a metamorphosis in the course of evolution is a new organ created from time to time, which then becomes the physical agent for the realization of new spiritual possibilities in the substance-world, the world of phenomena.

The organ of the heart, then, is an instrument of the blood circulation, created by it ; and the blood circulation is in turn a result of the action of the etheric formative forces. Such it has been both phylogenetically and ontogenetically.

We have already mentioned, in speaking of certain occurrences in the earth organism, the parallel between man and the earth, that man has a more intimate relation through his will, and therefore through the life of his soul, with the process of breathing than with that of blood circulation. Although we usually surrender ourselves to the customary breathing rhythm, which is in relationship with the breathing of the earth organism, yet we can, if we will, alter our breathing rhythm in either direction—accelerate it or retard it, render it regular or irregular, or control it arbitrarily. *Thus there exists a direct relation between the life of the soul, the will, and our breathing.*

The book of Genesis refers to profound realities when it describes how God created " man " : " And He breathed into him the breath of life. And man became a living soul." The mystery of the Biblical story of creation can often reveal to us more of reality, if we only consider this account rightly, than is revealed in many scientific hypotheses of our time concerning these things.

This relationship between will and motion is not the same in the case of the blood circulation as in that of breathing. We have already shown that, while the breathing of the earth organism is based upon its own life, the circulation of warmth, on the contrary, is induced by external cosmic influences, especially those of the sun. So also the individual life of man has almost no arbitrary influence upon the blood circulation ; we cannot by action of the will immediately direct the circulation of the blood, as is possible in the case of breathing. There are, certainly, delicate beginnings of such an intimate mutual relationship between the individual soul life and the blood circulation, as this is experienced in human fear and shame. When we are frightened or horrified, we grow pale ; when we feel shame, we blush. This, however, signifies only that, when the soul performs the act of fear, we draw the blood away from the periphery, the skin, to the centre into the organ of the heart ; when the soul performs the act of shame, then we spread the blood out from the centre, the organ of the heart, all the way to the periphery : that is, we " blush." In this externalizing of our soul life, we begin in an individual manner to intervene in the activity of the etheric formative forces ; and thus to act by means of the soul life through the medium of these etheric formative forces upon the physical organism. Thus we have here premonitions of a coming more intimate relationship between the human soul life and new spheres of his organization. But, when the will of a being—in this case of man—grasps such possibilities, then the action of this will leads, in course of time, *to the formation of new organs, to new experience-contents and perception-contents and therewith to a new consciousness-content.*

The representatives of the dying, abstract post-Kantianism will explain the possibilities of consciousness of the living human being, forever evolving, without considering this evolution forever altering organs or forming new ones, through the impulse of the being's will, and without considering the complete change in the limits and the nature of the content of consciousness, which is brought about through the formation of new organs, whether physical or etheric. Instead of considering these realities in concrete fashion, men satisfy themselves with that juggling, foreign to life itself, with the concepts of " intellect " and " reason " (*Verstand und Vernunft*), which, viewed in this manner, are merely the splitting of hairs, the still-born thoughts of the human brain.

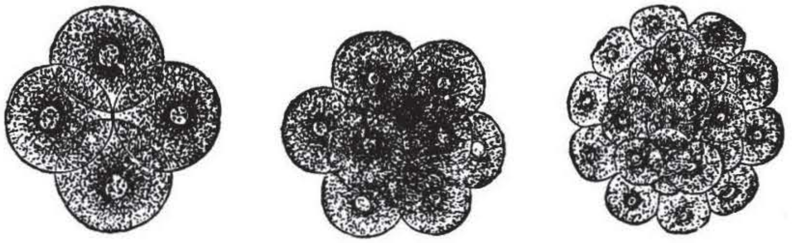
If men wish to understand the realities of an objective spiritual world vitally sharing in the evolution of our cosmic system, they will never arrive at such a goal by means of these games of concepts derived from the followers of Kant. To this we shall return later.

The etheric in the human organism not only induces the phenomena of motion, but works also as moulder of form, as we have already seen, wherever it appears in Nature. The forms of the cells and of the blood corpuscles—those most important bearers of the phenomena of life—are extremely varied and characteristic for the various kinds of living beings.

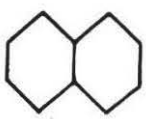
We have shown that the etheric formative forces thus work as moulders of form : that in the substance world the warmth ether tends to form spherical shapes, the light ether triangular shapes, the chemical ether half-moon shapes, and the life ether square shapes ; and that these four etheric formative forces have evolved phylogenetically one out of another. Now in organisms also we can find these different form-creations, corresponding to the contemporaneous stage of evolution of the organism, and especially in the following variations :—

Warmth ether :

Such spherical forms are often found in Nature, especially in the first primal organs, the cells. (Taken from Gegenbauer-Hertwig.)



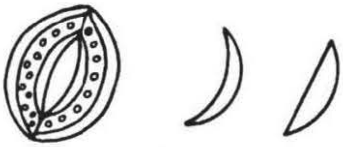
Warmth ether and light ether working together :



Spherical and triangular forms are combined.

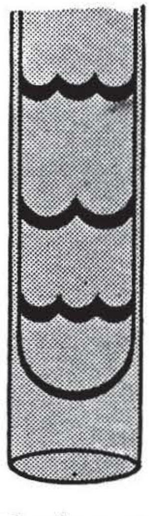
Especially in the cells of animals is this class of forms one of the most common.

Triangle and square are combined. Light ether and life ether are combined.



Chemical Ether :

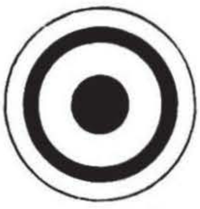
We have already recognized the half-moon forms of chemical ether in the plant kingdom.



This ether shows its form-shaping activity conspicuously in the half-moon shaped heart-valves at the outlets of the human heart and in the blood vessels. Here the chemical ether works, not only as a contracting force, which—in conjunction with the expanding light ether—causes the circulation of the blood, but it shows itself also in the fact that it gives to the substance in these places of constant rhythmic action the half-moon form.

Larger examples of these primal forms appear in the suprarenal glands lying within the rhythmic system : for example, in the fact that the right suprarenal gland is more triangular (light ether) and the left more half-moon shaped (chemical ether), etc.

Professor O. Schultze says in his " Lehrbuch der topographischen und angewandten Anatomie "* (edited by Professor W. Lubosch, p. 203) : " The more triangular right suprarenal gland borders on the liver and . . . ; the half-moon shaped left suprarenal gland borders on the stomach and the *aorta abdominalis.*" From the point of view of the etheric formative forces, which build the organs and induce the life processes, this organ on the right side of the body is more subjected to the light ether and its triangle-forming tendency ; that on the left side of the body more subjected to the chemical ether and its tendency to form half-moon shapes. We shall generally find in the human organism in relation to its internal organs that the right half of the body is more adapted to the forces of light and warmth ether and the left half to those of life and chemical ether. Indeed, it is one of the most important facts for research in organisms that certain organs, even from the earliest fœtal stage, incline more to the right half of the body (liver, gall bladder, etc.) and others more to the left half (heart two-thirds left one-third right ; stomach two-thirds left, one-third right from median line ; intestines, œsophagus, pancreas tending toward left ; spleen altogether left, etc., see also p. 219). This relationship—naturally highly differentiated—especially the distinction between the male and the female organism, we shall discuss more thoroughly in Vol. 2.



Very remarkable is the structure and form-shaping in the blood. If we illuminate a human blood corpuscle in the right way, we shall perceive four different spheres, proceeding from without inward as follows : first a bright sphere ; then a dark sphere especially permeated and swollen with liquid substance ; thirdly again a bright sphere, and again fourthly a dark sphere. These four distinct spheres in the substance of the corpuscle are the result of the etheric structure of the human corpuscle. The outer bright sphere is controlled by life ether ; the inner bright sphere by light ether ; the outer dark sphere especially filled and swollen with fluid is controlled by chemical ether. The chemical ether acts especially upon the liquid state of aggregation of substance, and this formative force has, therefore, collected the fluids in this particular sphere of the blood corpuscle. The qualities mentioned in connection with the several formative forces reveal themselves in all these details. The inner dark sphere of the human corpuscle is controlled by warmth ether. It is the foundation for the warmth of human blood.

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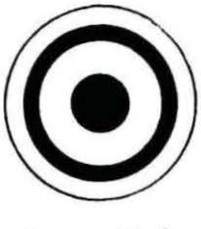
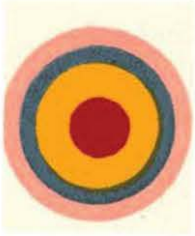
* München, 1922.

Human blood corpuscles, then, have this etheric systematization :

Outermost sphere : Life ether
Chemical ether
Light ether
Innermost sphere : Warmth ether



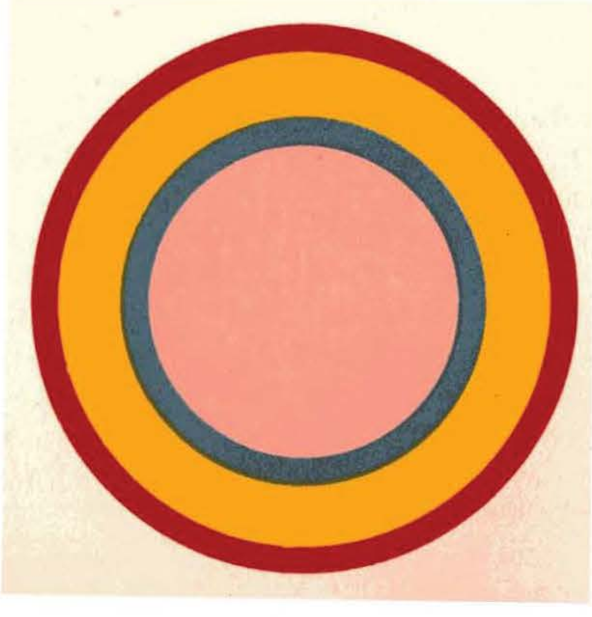


Let us now recall that we have already found such a systematization in considering the etheric structure of the earth's interior (pp. 99-101). As we have followed the evolution of the Saturn body to the Earth body and the outer earth by reversal to the inner earth, we have recognized *this etheric structure as the highest yet reached in the genesis of the macrocosm.*

We face here one of the most sublime primal phenomena in our cosmic system : *The etheric systematization of the blood corpuscle of a man is a copy of the etheric systematization of the interior of the earth.* The same formative forces, in modelling the body of the earth and the blood corpuscle of a man, have created the same image.

The fate of the earth and the fate of man are thereby closely bound together. That which arises in the etheric earth will always be reflected in the blood corpuscle of man. Through the mediation of the etheric formative forces there exists an eternal mutual relationship between the earth and man, between the macrocosm and microcosm a common harmonious evolution.

Moreover, still another primal phenomenon is herein revealed : the distinction between inorganic and organic substances, the living and the lifeless.



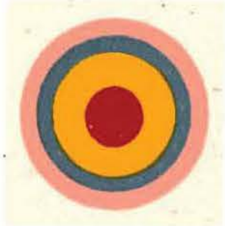
We have shown that the outer earth reveals the following etheric systematization, and that this is also true of the smallest entities of substance (p. 150), as these reveal themselves in the dissolution of dead mineral substance in radio-activity.

The etheric systematization of the outer earth and similarly of inorganic lifeless units of substance is, therefore, as follows:

Outermost sphere : Warmth ether,
Light ether,
Chemical ether,
Innermost sphere : Life ether.

The etheric systematization of the inner earth and at the same time of the organic, minute living units, the human blood corpuscles, is as follows:

Outermost sphere : Life ether,
Chemical ether,
Light ether,
Innermost sphere : Warmth ether.



Just as the interior of the earth in its etheric systematization is a reversal of the exterior of the earth, so also the minute living unit of substance is a reversal in its etheric systematization of the lifeless unit of substance.

In the case of the body of the earth, the exterior is related to the interior as in the case of units of substance the lifeless is related to the living. Herein is revealed the most significant law of evolution of our cosmos.

The genesis of the red and the white corpuscles in man we shall describe separately after introducing first further phenomena belonging to this chapter. The different kinds of intervention of the formative forces in the genesis of man and in the genesis of the vertebrates become especially clear to us when we examine blood crystals under the microscope, since in these the primal forms and their variations are very sharply manifest. Professor R. Tigerstedt gives in his "Textbook of Human Physiology"* pictures of blood crystals which are very typical for our description of the etheric. (Diagram, p. 214.)

The primal forms, which we have already observed in considering the plant archetype—the leaf, in the shaping of the periphery of the leaf, appear likewise in the blood crystals of man and the animals. Very decisive now is the fact that in the case of one of the lower animals (the Guinea pig) a formative force phylogenetically less evolved (light ether; see diagram) is active, whereas in the case of a more highly evolved animal (the squirrel) a formative force phylogenetically more highly evolved begins to intervene in the formation of blood (light ether and life ether combined) ; whereas in the case of man we find the primal forms of the formative force most highly evolved (life ether).

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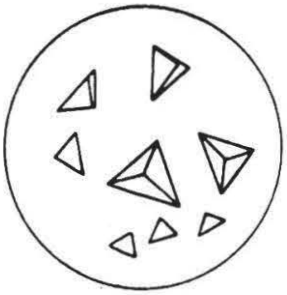
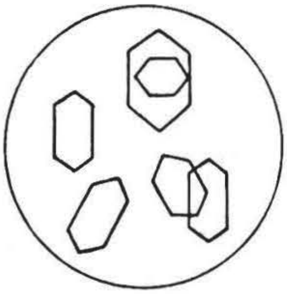
* New York and London, 1906. Fig. 46.



Crystals from blood of a Guinea pig.

Here are revealed the following etheric formative forces :

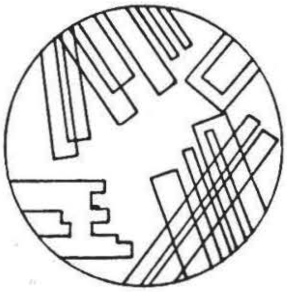
Pure triangles (Light ether).



Crystals from blood of a squirrel.

Combined triangular (Light ether) and rectangular (Life ether)

Transitional forms.



Crystals from human blood.

Pure rectangle (Life ether).

In this matter the horizontal and vertical currents of the earth-organism, whose relationship to the position of the spine and to states of consciousness we have already described (p. 71 ff.), play also a weighty part. Thus we find the least evolved formative force in the blood of that animal whose spine is still entirely horizontal. More highly evolved forces begin to express themselves in the blood shapes of an animal which is passing over to the habit of holding himself erect (the squirrel). Finally the highest formative force shapes the blood crystals of man, who is in his waking life completely vertical in position.

The more highly evolved an organism is, the more highly evolved is the formative force which intervenes in the shaping of its blood.

Thus in the kingdoms of Nature we find variations of these primal forms in the condensation forms of the earth's atmosphere (hail, etc.) and in the human breath (p. 159) as well as in the shapes of the leaf peripheries, the skin tissue, the cells and the blood corpuscles, and finally also in the forms of the nerve ganglia which are the basis of our nerve-sense activities. Just as the form-building tendency of the etheric formative force predominant at the time shows itself in the leaf periphery of plants—as if solidified there in its form of activity—so also in the substantial forms of the cells, tissue, blood corpuscles, and nerve ganglia there appear also the forms of those etheric formative forces which have either brought into existence these particular substance-shapes or else have their constant centre of activity in these organs. Thus those nerve ganglia which are centres for the action of chemical ether are also in their external form half-moon shaped, those of light ether generally triangular, those of warmth ether spherical, those of life ether a combination of rectangular forms. Those ganglia in which several ethers are concentrated have corresponding composite forms. In this manner, if one does not wish to proceed only from the point of view of the etheric in investigating the genesis of the physical-corporeal, both organic and inorganic, he has a starting point in the above mentioned forms in the earth organism and in the human and other organisms, and may in reverse order, on the basis of the physical form, determine the corresponding etheric element. This must be done obviously—since we are dealing here with living organisms and not with lifeless substance—less with measurements in centimetres than with the eye of a researcher who views things organically and is familiar with the principles of metamorphosis. Then, however, we shall find the most far-reaching points of connection for the mutual relationship between the substantial and the etheric.

In future it will be possible systematically to trace the phylogenetic and ontogenetic relations of the various cells, blood corpuscles, nerve ganglia, etc., to the activities of the etheric formative forces ; it will furthermore be possible to trace the manner in which the architecture of the ether body leads to the evolution of the inner organization from the germ-layers even to the complete organism ; for, as Hertwig says of the inner organization (p. 395), " so far as it can now be followed in its ontogenetic development," it has " come into being from the frequently repeated infolding and unfolding (invagination) of the primary inner germ-layers." That such infoldings and unfoldings are the work, both in the macrocosm of the planetary organisms and also in the microcosm of man in his embryonal development, of those " active builders " the etheric formative forces—this we have already discussed in Chapter XI and illustrated by impressive examples. In this way we shall come to a concrete basis for embryology, and no longer resign ourselves and come to a standstill before the understanding of this first stage in man's development. That we cannot reach such a basis without drawing upon a knowledge of cosmic activities—since the human organism is during the first stages of its evolution more than at other periods subject to the activities and formative forces of the macrocosmic world organism and receptive to their influence—we have already shown in considering the planetary etheric spheres in Chapter III.

It is extraordinarily interesting to trace the way in which the evolving human being as an embryo, as a child, and then during the change of teeth about the seventh year, and at puberty about the 14th year—that is, in the upper and the lower pole—is seized upon and influenced by the etheric formative forces in ever new forms and with higher functions in the growing organism. Whoever views the world and man in their unity will not perceive some sort of unintelligible mysticism in the fact that these organic processes complete themselves in seven-year rhythms (about the seventh year, change of teeth ; fourteenth year, puberty ; twenty-first year, maturity of understanding, the " majority "). The same investigator who thinks organically and livingly sees therein a sign, wonderfully harmonious and absolutely self-evident, that the etheric formative forces which bring about in great rhythms the formation of our macrocosmic system with its seven analagous planets, its seven-toned musical scale, its seven-coloured light spectrum, its seven-staged arrangements of the chemical elements, etc., also maintain similar and identical rhythms when they create the architecture and evolution of the microcosm of the human organism, woven in these rhythms of the universe and the earth. Anatomy will never come to an understanding of these vital phenomena so long as it undertakes to investigate the human body apart from these great rhythms and processes of the cosmic organisms and earth organism, into which, indeed, man is involved as a being living in the world of substance.

Concerning the evolution of the embryo, the child, and the human life-stages with their reciprocal action of spiritual, soul, and bodily metamorphoses, a thorough knowledge of which is of decisive importance especially for a pedagogy which shall enter into the being of the child, Dr. Rudolf Steiner has given comprehensive and convincing material.

The interdependence between the etheric in the earth organism and in the human organism becomes especially clear to us in considering the action of the so-called " gravitation," terrestrial magnetism, in the formation of the human organization. In discussing the subject of gravitation and magnetic phenomena (Chap. III) we have seen that it is the action of life ether which draws bodies toward the life-ether centre of the solid earth. If we investigate the substances of the human physical body with respect to their susceptibility to the several etheric formative forces, we discover that lymph, for example, stands in close relationship with the forces of life ether. Since this ether works outward from the earth as a free force, therefore the lymph system has been grouped in the living organism in its most important organs about the lower pole, the metabolic pole, which is also the centre of gravity of the erect man with his lower pole directed toward the centre of the earth. Especial attention should be given to this in order to show how the static and dynamic distribution of the several substances in the living organism and their relation to the structure of the earth organism may be understood through a concrete consideration of the etheric. The direct relationship between the lymph system—so extraordinarily important for the phenomena of life—and the life ether becomes clear through the fact, among others, that the so-called white or colourless blood corpuscles proceed out of the lymph system, while the so-called red corpuscles do not appear there. Professor Tigerstedt says*: "The white corpuscles are formed in extra-uterine life chiefly in the spleen and lymphatic glands; from these issue mononuclear cells, lymphocytes, which are transformed into polynuclear cells in the blood stream." And Nägeli, who opposes the opinion of Ehrlich that the white corpuscles are formed in part in the spinal cord but chiefly in the lymphatic apparatus, writes thus (p. 127): "The lymphatic system is most intimately connected with the lymph-vessel system. To this belong the lymph glands, the lymphatic apparatus of the digestive tract, the follicle of the spleen, and lastly the small and very small lymph follicles present in the whole organism. . . . The building of this lymphatic system is everywhere the same. Follicles appear consisting only of smaller lymphocytes; and only with the stronger functioning appear brighter centre zones, the germ centres, which then arise out of the greater lymphocytes. Vessels leading inward and outward . . . mediate the circulation. . . . The pedigree of the lymphocytes is, accordingly, always simple and invariable. The little blood-lymphocytes come from the greater lymphocytes of the germ-centres, and these greater lymphocytes are the daughter cells of the small lymphocytes of the stable tissue of the follicles."

It is interesting that man forms, on the one hand, the colourless blood corpuscles in his lymph system grouped round the centre of gravity by means of the formative force of life ether proceeding from the centre of the earth; whereas, on the other hand, when man ascends to great altitudes, mountains, etc., so that he takes himself out of the life-ether sphere and the chemical-ether sphere into the light-ether sphere of the earth organism, then, as has been proven, predominantly red corpuscles are formed. Tigerstedt discusses in his "Anatomie" the fact of this increased formation of red corpuscles upon high mountains—that is, in the higher regions of the atmosphere (p. 191) : " As Viault first remarked and as has later been confirmed by many authors, the number of red corpuscles increases generally in the peripheric circulation very notably and that even on the very first day. In the heart blood, however, one finds no increase in corpuscles, but on the contrary a diminution. After a few days, however, there appears a real formation of new red corpuscles. Even in the heart blood they now appear in greater numbers. The total mass of red blood colouring matter has increased, and in the red marrow, the place where red blood-corpuscles are formed, there appear undeniable signs of increased activity, while also nucleated red corpuscles appear in the blood stream."

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* loc. cit., p. 153.

Thus, if it is principally the life ether working upon a certain part of the organism (the lymph system, the centre of gravity, the life-ether sphere), then the so-called colourless blood corpuscles appear ; if, however, as in the higher layers of the earth atmosphere (light-ether sphere of the earth organism) the light ether is chiefly active, then there appear red corpuscles !

Moreover, it is characteristic that in the ontogenesis of the embryo, the etheric formative forces so work in the sense shown above that the ether forces phylogenetically earlier (for example light ether) also begin to affect the evolution of the embryo earlier than the formative forces later evolved (life ether). Nägeli in his work " Blutkrankheiten und Blutdiagnostik " says (p. 75) in regard to the succession in time of the formation of white and red corpuscles : " The chief basis for the distinction in principle between the erythrocytes and the leucocytes is the repeatedly established and generally accepted fact that during a long period in the embryonic process only red blood cells exist and no white ones."

Thus ontogenetically there appear first in the embryo the red blood corpuscles, formed under the influence of light ether (consider also their increase in the light ether sphere of the earth) ; and only later the white corpuscles, formed under the influence of the life ether, which was also evolved phylogenetically later.

Nägeli gives furthermore the following representation (p. 132) : " Embryologic studies in the formation of leucocytes in the mammals, as is shown especially by the work of van der Stricht, give results identical with those obtained in researches with human embryos. Ontogenesis is always an abbreviated phylogenesis. . . . If one goes back in the series of the vertebrates, then from the amphibians on we fail to find the lymph glands ; there is only the thymus which has a lymphatic tissue ; the marrow, however, corresponds with the myeloid formation. . . . From this point of view of organ-formation, therefore, the lymphatic tissue is later in appearance, whereas myeloid formations come earlier and are therefore phylogenetically older."

From the point of view of the ether theory already developed, we can now indicate the general laws which lie at the basis of all the phenomena, as follows :—

In the phylogenesis of the macrocosm, light ether was formed earlier than life ether (Chap. II). In the phylogenesis of organisms, the system of organs serving for the formation of red corpuscles appears earlier than the system of organs serving for the formation of white corpuscles (lymphatic system, etc.). In the ontogenetic evolution of embryos there appear earlier also, according to these general laws, the red corpuscles, formed by the earlier evolved light ether, and later the white corpuscles, formed by the later evolved life ether. Yet, if man, as a fully developed organism, puts himself in the light-ether sphere of the earth organism (on high mountains, in the upper atmosphere), there arises as a result an increased number of red corpuscles. If, on the other hand, there work in his system the forces of the life-ether sphere of the earth organism (in the lower atmosphere), there arise increased numbers of white corpuscles.

All this is throughout in harmonious agreement with what has been said concerning the structure of the " ether body " of the earth organism.

Very characteristic also, for example, is the relation between the spleen and the red and white corpuscles respectively. It is said to be on the one hand a very important breeding place for white corpuscles (see Rauber, Kopsch) and on the other hand a place of destruction for red corpuscles (Schaffer). The spleen is one of the organs adapted to the left side of the body. As regards the relation of the right and left sides to the several etheric forces see p. 236. The fact that, when the spleen is removed from the body, its functions continue to be performed shows that the " ether body " of the organism carries on its activity even when the physical organ disappears, that the formative forces then build for themselves new auxiliary organs.*

Very significant, furthermore, is the fact that one of the most important organs for the formation of the lymphocytes, the thymus gland, which, in the case of the embryo and also of the child before puberty, is the chief producer of white corpuscles—therefore, of the most important of life elements—begins to diminish at puberty, at the end of the second seven-year period, or about the fourteenth year, and no longer continues to serve for this vital function. (Artificial removal of the thymus in young animals has been followed, according to Tigerstedt, by a notable diminution of the leucocytes. Early use of the sexual function results in an accelerated atrophy of the thymus. Here we have a striking example of the way in which the action of the etheric formative forces—in this case life ether—takes up a new work in the organism and leaves off an earlier task; for the period of twice-seven years intense formation of the body-building colourless blood corpuscles by a certain organ, and then, with the beginning of puberty, the disappearance of this organ, while the formative forces seek a new field of activity. Moreover, the parallelism between puberty and the change of voice in boys is connected with the fact that the formative forces change their field of activity in the organism at a certain stage of evolution. Here we can only allude to the relationship between warmth ether and light ether on the one side and chemical ether and life ether on the other and low and high tone-pitch respectively. (See pp. 205 ff. 216.)

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* See in this connection the important pamphlet by L. Kolisko which introduces a new point of view in regard to the subject : " Milzfunktion und Plättchenfrage," Stuttgart, 1922.

An important distinction between the circulation of lymph and that of blood consists in the fact that the first contains almost no oxygen, whereas for the blood oxygen is one of the most essential elements. But the manner in which oxygen, so decisively important for the life phenomena, appears and acts in different variations in the living organism, —this has hitherto not been understood in accord with reality for the reason that in these things a merely quantitative, formula-determining view results in a caricature.

Hertwig describes the mutual relationship of blood and oxygen as follows (p. 398): "The blood circulating through the bodies of animals (or the hæmolymph in the case of invertebrates) mediates the exchange of gases; on the one hand it takes up in the inner organs and tissues the carbonic gas arising from dissolution, and through the respiratory surface it gives this to the external world as useless final product of the process of metabolism. On the other hand it takes in exchange for this oxygen, which is then delivered through the circulation in the interior to the cells which require oxygen. *Most completely does the blood thus carry out its rôle of intermediary if chemical combinations have arisen in it which through their labile affinity for oxygen can take this up readily and as readily release it.*" But Hertz has already most emphatically pointed out, and Hertwig agrees with him, that the term *affinity* merely gives a name to a phenomenon which it has been entirely impossible to understand, but that it does not explain this phenomenon. For what in the final analysis induces a substance through "labile affinity" first to seize greedily upon oxygen and a second later to thrust it away—this cannot be in the least explained on the basis of mere processes of substances. We must here also reach back to take hold of the forces active within substances in order to understand this labile process. The problem, then, runs thus: What forces are active in one part of the organism, to form the substance-structure of the so-called oxyhæmoglobin; and what other forces are active in other parts of the organism to cause this process of forming oxyhæmoglobin to reverse itself? We shall understand this process concretely if we recall in what different ways the different etheric formative forces are related to oxygen.

A distinction of great importance for an understanding of the phenomena of life is to determine in which systems, organs, and parts of the body the threefold oxygen (O_3, ozone) is formed, and in which others the twofold (O_2). (See also Chap. VII.)

If, now—as we have already shown—we merely distinguish in a calculating mechanical fashion between a threefold union of oxygen and a twofold union of this substance, our understanding remains outside the real nature of the phenomena. It is not merely a question as to the quantity in which something substantial is there united, but by means of what formative forces one thing and another thing are held together and with what qualitative characteristics these formative forces are associated! Only this touches the nature of the thing. If, now, we examine the matter from this point of view, we discover, as has already been said in connection with the light phenomena in the earth organism, that the threefold oxygen is associated chiefly with the formative forces of life ether, but also those of light ether, and the twofold with the two remaining formative forces, chemical ether and warmth ether. (See Chap. IV., The Ontogenetic Genesis of Substance.)

The chemical formula $O_3=O_2+70$ Cal. of heat says nothing to us except that heat manifests its presence along with twofold oxygen, whereas with threefold there is no heat; this can convey nothing further to our understanding. The question "Why?" sends us unescapably to the etheric. When the substance O_3, formed in the light-ether sphere of the earth organism with the life ether, descends into the lower layers of the earth atmosphere, heat appears in the phenomenal world ($O_3=O_2+70$ Cal. of heat). Heat results, as it were, from the "sacrifice," the descent into denser matter.

More recent research has brought to light the fact that in reality in the breathing, blood circulation, etc., of living beings, not only do twofold oxygen and water appear, which we encounter and inhale in the lower strata of the atmosphere, but that the living organism in many parts causes within itself a re-formation of O_3 from O_2 on the one hand and H_2O_2 from H_2O. *Thus we see that the living organism reverses within itself processes which the earth organism first produced, a truth in which are concealed many mysteries of the cosmic evolution.*

Ozone and hydrogen peroxide have in recent times been proven to exist in the vital fluids of most animals and plants, chiefly, however, as a phenomenon always accompanying assimilation and as an intermediate product of respiration.

Now, it is exceedingly interesting to trace the manner in which the living being, by means of the forces working within him, brings about that labile transformation from twofold to threefold oxygen, and back from threefold to twofold. It has already been amply demonstrated through experiments that the blood is a very powerful catalyzer for this sort of process. What the blood does here is only the following: it causes the so-called " slow combustion." It is a basic phenomenon that this slow combustion is an attribute of all living beings; should the combustion proceed here as rapidly as it does elsewhere in Nature—as, for example, in a burning candle (p. 133)—the whole life-process of a man, for instance, would move at a tempo far too rapid; and man could then in his spiritual evolution not keep pace with the tremendously accelerated physical evolution. Then he would naturally have a much briefer duration of life than he has at present, because the using up, or " ageing," of the organism would begin much earlier. We may state the matter thus: Through this transformation, the blood causes a transitional metamorphosis from the laws of the " warm flame " to those of the " cold flame "; it thus checks the rapid combustion within the organism and renders possible the slower process of combustion in the living being, the slowing down of the life processes, so necessary for the spiritual evolution.

Already in considering the phenomena of radio-activity, which exert so great an influence upon life phenomena (Chap. X), we have seen that in this way ozone and hydrogen peroxide are on the one hand formed and on the other hand destroyed. The same thing happens also by action of the blood—that is, the etheric formative forces active in the process of the circulation of the blood. The organism receives the air, the twofold oxygen, brought in through the lungs and the breathing tissues; changes this into threefold (" cold flame," retardation of life process, oxyhæmoglobin) and only *after a part of the organism has been coursed through in this way does the re-formation take place from* O_3 *to* O_2 *(+ 70 cal. of heat); and hereby comes into manifestation that heat which is characteristic for the heat-processes in organisms (" warm flame ").*

The conflict between the two etheric formative forces, light ether and chemical ether, which lies at the basis of the life phenomena of the rhythmic system, leads, as we have seen in the course of this chapter, to many and varied goals. It manifests itself not only in the rhythm of breathing in the corresponding organs, but also in the inner tone-world of man, which leads to speech. It manifests itself not only in the rhythm of the blood circulation, but also in the substance-structure of this blood in motion—the most vital of all body-building elements. Here this conflict is the *basis of life* in the following manner :—While the light ether, together with life ether, forms the threefold oxygen, it is working according to the laws of the cold flame, of the upper pole, the *consciousness* pole ; but, when the chemical ether, on the contrary, forms the twofold oxygen, it is then engendering the life element of the " warm flame," the lower pole, the *metabolic* pole ! Arterial blood or venous blood, slow combustion or rapid combustion, retardation or acceleration of the course of the life-processes, protraction of life in the substance world or hastening of the arrival of death—these alternations work themselves out through this eternal conflict.

It may be said, therefore, that in the human rhythmic system (breathing, blood circulation, etc.), the light ether works for the upper, consciousness pole ; chemical ether for the lower, metabolic pole, the substance pole ; the one formative force works for the physical basis of the spiritual life ; the other for the physical basis of the corporeal life.

As long as man lives in the substance world, neither of the two conflicting formative forces is victorious, *for the living man* establishes and maintains an equipoise until the moment of death. The " life " of man thus manifests itself as the maintenance of an equipoise between conflicting polarities. Therein lies its nature.

Since all these processes are extremely labile, and in constant alternation gradually pass one into the other, they can never be completely understood by means of chemical formulæ. Distinguished investigators admit that the formulæ established for oxyhæmoglobin, hæmoglobin, etc., do not fit the essence of the reality. By means of chemical formulæ it is possible really to signify merely with what substances, approximately, the formative-force complexes here present are working, but the substance-structure is in continuous change. This, indeed, is the distinction between living beings and inanimate things, as we have already seen in connection with the earth organism : the inanimate hardens according to its general laws, according to its structure (rigor mortis, coagulated blood, etc.) ; but substance permeated by life, on the contrary, is constantly being disorganized, or reduced to chaos, in its combinations and connections, modified, prevented from hardening into fixed dead laws. In that the etheric formative forces prevent this fixing of substance, they maintain the organism in life, they set up the great eternal principle of life : *without the ether body, the physical body of man, of the earth, and of the cosmos would change into corpses.*

If the organism loses its ether body with its inner mobility, paralysis comes to the living, and stiffening to the dead body, the blood and muscular fluids coagulate, etc. If for a moment a part of the ether body withdraws from the limb of a living body—a leg or an arm, for instance—we say the limb " has gone to sleep " ; for the moment we lose our control over this limb while this is in itself immovable, is stopped in its processes of circulation, etc. But the basis for this lies in the fact that, in the case of a hand " gone to sleep," the corresponding member of the ether body has shifted itself and withdrawn from the physical member. As soon as the etheric member again enters into the so-called " sleeping " physical member, that member at once recovers its previous vital mobility and sensitiveness to stimuli. (Concerning the essence of " stimulation," see Chap. XI.) When a corpse loses its rigidity, about the third day after death, the etheric body has completely withdrawn from the physical body of the man ; the corpse is now no longer subject to inner, but only to outer laws, which thenceforth destroy it and dissolve it according to the general unindividualized laws of Nature : the corpse decays. An anatomy which draws only upon the physical body of the organism, and not also the ether body, describes thus only the corpse, not the living organism ; to the latter belong also those other vital " members " of the human being, if he is to be understood in every detail according to the laws of reality.

It is interesting to follow the phylogenetic and ontogenetic process in the course of which the etheric formative forces shape and group the different substances of the organism. Just as the genesis of the etheric formative forces proceeds and ascends from warmth ether to light ether, to chemical ether, and to life ether, thus so the process of condensation of the organic substances manifests the most varied stages in blood, in soft parts of the body, in nerves, and finally in the bony system. So also the skin, the albumen, the brain substance, the starch and sugar substances manifest a metamorphosis in evolution which would not be possible without the etheric formative forces. For the influence of chemical ether upon the genesis and maintenance of nerve substance, for instance, it is very characteristic to observe that the artificial abstraction of water from a nerve causes the strongest excitations, whereas the introduction of large quantities of pure water generally has an immediate deadening effect upon the nerves (Professor A. Waller)—a fact which shows the significance of the " dose," but shows also the intimate connection between the nerve substance and the chemical ether which controls watery substances (Chap. II, etc.). On the other hand rays of visible light (light ether) have a marked effect upon albumen, and practically none upon muscle, etc. The metamorphosis of one substance into another, and the alternation of functions on the part of cell complexes through the passing of the various etheric formative forces from the active to the latent state and *vice versa* we have already set forth in detail in Chapter XI.

Finally, a future study of the senses will be able to discover elements for an understanding of this subject from the reciprocal relationships between

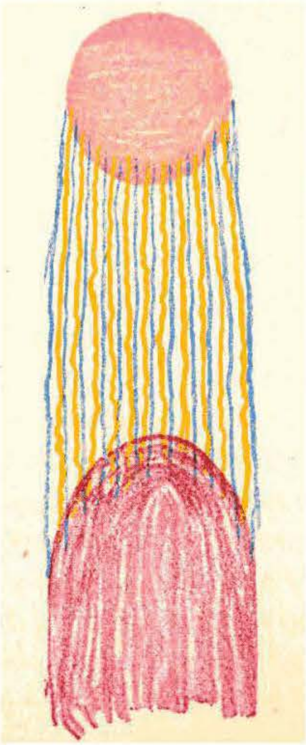
The sense of heat and warmth ether,
The sense of sight and light ether,
The sense of taste and chemical ether,
The sense of hearing and chemical ether,
The sense of smell and life ether, etc.,

as well as the remaining senses and their intimate relationships to etheric processes. In this connection what has been said in Chapter XI in regard to " stimuli " will apply to the human organism also. Indeed, in regard to a theory of the senses Dr. Rudolf Steiner has already provided extensive material which the sciences of physiology, psychology, etc., when these draw upon the etheric, will be able to develop to a comprehensive realm of knowledge. The branch of the discussion to which we are here limited does not render possible, unfortunately, a detailed discussion of this far-reaching material.

We have already mentioned the relationship between the forces of speech, so important for the development of consciousness, and the rhythmic system ; but still other associated processes may now be explained if we trace the manner in which the rhythmical variations in the pressure of the cerebral fluid, due to the ether body of the rhythmic system, stand in intimate relationship—through the intermediary of the etheric—with nerve-sense impressions on the one hand, and with the processes of breathing, blood-circulation, and blood-formation on the other. *Here is one of the most essential meeting points, where that which enters into our head as a sense impression—that is, enters through the organs of sensation into the living organism—meets with that which lives in our breathing and blood circulation : that is, where the content of sense-perceptions and influences meets with the physical bases of our speech, on the one hand, and of our body-building elements* (*blood, etc.*) *on the other. The etheric formative forces work in both entities.*

The activity of consciousness in man, living in the phenomenal world, is—so far as this requires a physical basis—dependent in the most far-reaching ways upon the existence of these rhythmic processes in the cerebral fluid. It is significant that the human brain is not subject like the rest of the organism to the force of gravity directed toward the centre of the earth ; but, since it is subjected to the upward pressure of the cerebral fluid, with its variations, *it is freed to the utmost extent from the attraction of the earth.* The laws, therefore, of the upper pole of man stand in opposition to the laws of the earth organism, as these hold sway at the lower pole in man, where the nutritional material taken from the terrestrial environment is worked up, and where no organ necessary to our waking consciousness is formed. In the head (upward pressure by the cerebral fluid means release from gravitation) there hold sway, therefore, according to this point of view, laws which are anti-terrestrial ; in the lower man (digestive system), on the contrary, we find predominantly terrestrial laws. *Here also we find a polarity between terrestrial laws, on the one hand, and extra-terrestrial or cosmic laws, on the other ; and as a result we see in the human organism also a polarity of a spiritual kind (waking consciousness centralized above, not below), as also a polarity in the etheric formative forces, which in turn leads to a polarity in the physical organism.*

The phylogenetic and ontogenetic genesis of the human physical organism must, therefore, for a real understanding, be traced back to the laws of the cosmos, of the cosmic organism and the earth organism. If we consider the ether body of man and its action upon the physical body, we have already been able to point out the distribution of the etheric formative forces in general in the following manner.


Consciousness pole
mineralizing tendency.
Life ether (pole of the "cold flame").
Rhythmical tendency.
Light ether and chemical ether.
Metabolic pole, combustion.
Warmth ether (pole of the "warm flame").

If, now, we consider the appearance of the different etheric forces in detail within the organism, and seek for their many smaller centres, we discover that many etheric centres coincide with the nerve ganglia in the human nerve-sense system, but there are more etheric centres than physical centres. It is now of decisive value to trace the manner in which the correspondence between the etheric forces of the nervous system and those of the blood system leads also to a most far reaching analogy between the shaping of these two most important systems. Since the same forces—only under different conditions—have formed both the nerve system and the blood system, the second is, therefore, in its formation almost a copy of the first. Let us consider first the two most important organs, the brain and the heart.

As the brain divides itself into an upper and a lower part (cerebrum and cerebellum), so also does the heart. Obviously, moreover, the right and left halves of the brain are distinct, so that there are in all four parts just as the heart is divided into four chambers. If we now trace this organic differentiation further, it becomes evident that the brain runs out into twelve pairs of nerves. Only the illogical abstractionist will consider this a mere " chance " ; to the investigator in the world of the organic it will be a matter of obvious necessity that the same etheric formative forces which brought into existence macrocosmically and phylogenetically twelve signs of the zodiac, caused also microcosmically, in the human organism at the focus of the nerve-sense system, just twelve pairs of primary nerves.

The structure of the heart, which is, in its development, at present still behind that of the organ of consciousness, shows in the *physical* organ, the four parts corresponding to the major parts of the brain, but not yet, on the contrary, the twelve-fold division corresponding to the further process of differentiation ; but the *etheric* heart possesses this twelve-fold structure—as Dr. Rudolf Steiner indicates in his book " Wie erlangt man Erkenntnisse der höheren Welten"*—and tends by nature in the course of its evolution to bring about this twelve-fold differentiation in the physical organ also as this has already been accomplished in the organ of the brain. That such a gradual development of the organ of the heart, like that of the brain, is associated with decisive modifications of the activities of consciousness and of the several members of the human being—this will occur to logical thought, in the light of phylogenetic events already visible to us in other branches of knowledge, as a necessity of Nature.

If we now trace the form of the nervous system in the rest of the organism—for example, in the spinal cord—we discover an entirely different structure ; and these differences are to be understood only if we apply to their understanding what has been said in Chapter III regarding the etheric currents of the earth.

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* Translated under the title " Knowledge of the Higher Worlds and its Attainment." London, 1928.

We there considered the position of the spine in the several kingdoms of living beings in its relation to the etheric currents within the earth organism, and discovered that man, when erect and in his waking consciousness, is subject in maximum degree to the influence of the currents induced by the sun ; but, when asleep and in a horizontal posture, to the currents induced by the moon ; and finally that animals, because of the horizontal posture of the vertebral column, are subject in maximum degree, even when they are awake, to the action of the moon. Whoever, for instance, observes a dog or other animal at the time of full moon and new moon, can collect a wealth of material bearing upon this.

Man, therefore, practises those highest activities of consciousness which belong to him alone of all the kingdoms of Nature by means of a brain which is strongly susceptible to the sun influence—as an entity—and we have seen that this brain in its twelve-fold structure corresponds to the twelve-fold division of the macrocosmic system into the twelve signs of the zodiac, through which the sun moves in the course of the year.

The activity of consciousness which man practises by means of the nerve system centralized in the spinal cord is far more subdued than the waking conscious activity of the brain ; the former resembles that of the animal, a more dreamlike consciousness. This nerve system, adapted rather to the animal-like consciousness, we have found in the animal to be subject essentially to the influence of the moon. If, now, we consider the origin of this spinal-cord system, we shall find an explanation in the fact that its structure must be rather a copy of macrocosmic events of the moon, whose formative forces were here specially active. Just as the month, a twelfth of the year, consists of 28-31 days, and in this rhythm the revolving moon shows to the earth its various phases—waxing and waning within one month—so also the spinal-cord nerve system of man is divided into 31 pairs of nerves. This nerve system mediates our reflex—that is, involuntary—movements ; its consciousness is dreamlike, does not resemble the daylight waking consciousness of the brain, but resembles rather the subdued consciousness of the animal and the sleeping man. Indeed, it is, in the animal when awake and man asleep, coursed through in maximum degree by the terrestrial current induced by the moon. (See Chap. III.)

The human organism possesses a third nerve system in the so-called " sympathetic nerve system," which has its most important organ in the solar plexus and develops its chief activity in the organs of digestion. This is the nerve system of the lower pole, of the metabolic system, and therefore of that part of the organism which is related chiefly to the earth organism in the assimilation of the nutritional body-building matter taken from the earth. This process at the lower pole proceeds normally in such a way that it does not enter at all into our consciousness: that is, our state of consciousness in relation to this real process is like that of deep sleep, wherein we know nothing of all that is going on in and around us.

By co-ordinating each of the three parts of the nerve system to one of the three systems of the human organism, so to speak, as its organ of consciousness, the threefold human organism reveals itself in the following manner:

Head system, sun influence.
Brain, 12 pairs of nerves (12 signs of the zodiac),
Voluntary movements,
Waking consciousness.

Middle system, spinal-cord nerve system, moon influence.
Vertebral column, 31 pairs of nerves (phases of the moon, month),
Involuntary movements,
Dream consciousness.

Metabolic system, sympathetic nerve system, earth influence.
Assimilation of the substances of the earth,
Deep-sleep consciousness.

Thus the states of consciousness, the etheric formative forces, and the processes connected with substance are all linked up in man both phylogenetically and ontogenetically in harmonious relationship with processes in the cosmos and in the earth organism.

Through this human organism there courses during the day still another etheric current, the " life current." Just as watery substances, ascend in vegetation during the course of the year and of the day, thus rendering possible the phenomena of plant life—which we have been able to explain on the basis of the breathing process of the earth organism, which exhales into the atmosphere and again inhales an etheric current (Chap. III)—so also do etheric currents from the earth organism stream through the human organism, alternately in and out during the course of the day and the night.

The relation of human consciousness to these realities is a unique thing. Just as the discoveries in the radio-active decay of substance, which have so profoundly modified our previous world-conception, were wholly unknown to modern science up to thirty years ago, and yet were realities during all the thousands of years preceding, so the human organism has for a long time been under the influence of these currents of etheric forces flowing through us from the interior of the earth, and yet human consciousness has never brought these realities within its reach. A research into the phenomena of life, which is in conformity with the reality, will require in future, however, to give attention to the profoundly significant nature of these things.

When the earth breathes out at sunrise the etheric formative forces which produce the phenomena of life in the plant world (Chap. III), then also does the life current begin to course through the human organism. Beginning at the feet—that is, since we are here dealing with etheric processes, beginning at the lower end of the ether body of man—the current of etheric formative forces enters the human organism, flows through the human rhythmic system, there vitalizing many lesser rhythms, and ascends to the brain. In the evening, about sunset, it flows back, and finally reaches again the lower end of the ether body, the feet, in the morning before sunrise, to begin once more from there at sunrise its course through the organism.

Diagram of the direction of the flow of the etheric life current through the human organism in the course of a day:

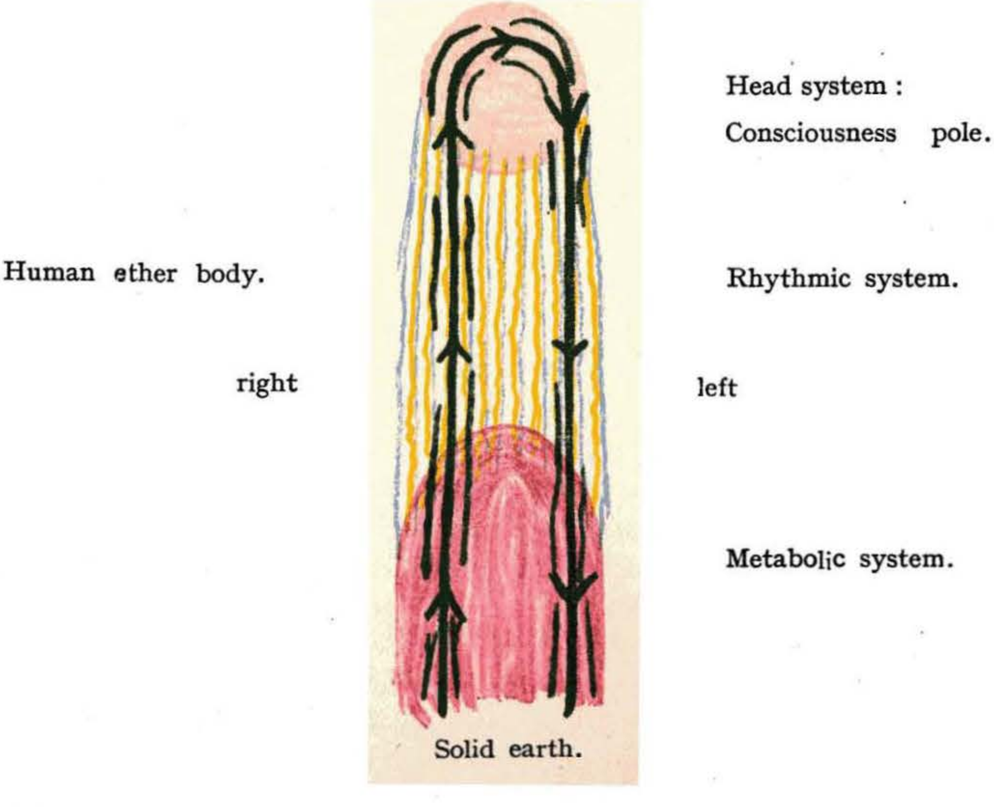
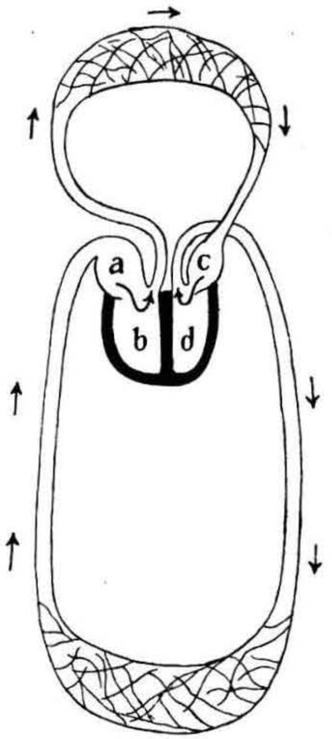


Diagram of the direction of the circulation of the blood in the human organism :



Lesser blood circulation.
Lung circulation.

Greater blood circulation.

Organ of the heart.

(a) Right auricle.
(b) Right ventricle.
(c) Left auricle.
(d) Left ventricle.

As the etheric current of breathing of the earth organism, rising in the course of the day from the interior of the earth and returning there, gives a fresh impulse daily through its rhythms and its formative forces to the phenomena of life in all the kingdoms of Nature, so does it course also through man, giving an impulse to the vitalizing circulation of his blood and keeping this in continuous flow.

And, indeed, the life current courses through the human organism upward chiefly on the right side and downward chiefly on the left. Through this fact and only so can the development of the circulation of the blood be explained. (Diagram above.)

The fact of the upward flow of the etheric life current on the right side and downward flow on the left explains to us, furthermore, why many organs in the human body are not placed symmetrically, but asymmetrically, that some belong more to the right sphere and some more to the left, and moreover why the movements of the fluids in the two regions tend for the most part in different directions. Further, the life current during the day—that is, when ascending—affects principally the *nerve system,* and during the night—that is, when descending—principally the *blood system;* and this fact is related to the states of human consciousness : the heightened *waking consciousness* of the day and the suppressed *dream and deep-sleep consciousness of the night,* and their transitions one into another.

But each man's own ether body also modifies in turn the general nature of the etheric life current of the earth and individualizes this within the human organism of each individual human being in such a way that it is individually distinct in each man from the current in every other man and from the rest of the terrestrial and cosmic currents.

We have already seen, in connection with breathing and the circulation of the blood, that these rhythms are partly subject to the human will and partly not so subject, and therefore enter into more or less intimate mutual relationship with the life of the human soul. *Here, therefore, the human and cosmic wills are often in contact either supplementing or disturbing one another.* Human will, human destiny, human health or sickness, and most of all human knowledge or ignorance of cosmic laws, may here upbuild or destroy very much. Great and essential mysteries of the opposed or united evolution of cosmos, earth, and man are here either open to view or concealed.

A new theory in regard to all these entities and organisms will lead also to a new *physchology, physiology, and anatomy* of the human being with widely extended spiritual horizons. Dr. Eugen Kolisko gives one an overwhelming impression of what is required in this change of view. He says that this new direction in research brings one to an " entirely new conception of the relation between that which belongs to the soul and that which belongs to the body. Anthroposophy can neither think of the bodily as the cause of phenomena of the soul, as is the case in the more or less materialistic mode of thought, nor can it speak of a parallelism of the psychic and the physical, as is done to a great extent to-day, simply recording these elements side by side, but it must investigate adequately what region of the life of the soul is related to a specific region of the life of the body. Previously men believed in a ' seat ' of the soul, which was conceived as being somewhere and in some way separated from what is bodily, in order to avoid bringing it into relation with gross matter. In this way the soul was conceived, not exactly as a ' gaseous vertebrate ' but at least in a very materialistic way. Then came a time when everything of the nature of soul was attributed to causes lying in the nervous system, and all soul functions were indiscriminately attributed to this nervous system. This is clearly a relic of the old theory of the ' seat ' of the soul, which is now supposed to be something proceeding from the nervous system and there localized. Anthroposophy will show how the soul is united with the *whole* man. In reference to the functions of the soul it must be possible to explain which physical organ is the basis for each of them.

" In this manner we part on the one hand with that psychology which leads to utter abstractions, and speaks of a soul element which has no relation to the physical—an inheritance from the old theory of the soul ; and on the other hand we part with the theory which thinks of the greater part of the human organism as having no relation to the soul and so considers this as it has been customary to think of the external world as being the product of physical and chemical action. A view of the body void of the soul element and of the soul void of the spiritual—such is this way of thinking, where one does not use the spiritual in order to comprehend the soul in its extraordinarily manifold relations with the body. These are the two extremes which Anthroposophy will refute. It perceives the element of soul in its polaric character and sees that this can be understood only as it is related to the polarically organized processes of the body. In addition one will be forced to see that thinking, for instance (not conceiving, which, as it were, projects further the external perceiving) comes about not only by means of the brain, but by means of the whole man, for in pure thinking there is present a factor of will in that one concept is consciously linked to another. But if thinking is real in its nature and if it leads to knowledge, then there is united with this will-permeated thinking also feeling. A thinking which, through the activity of will, leads into the spiritual and then bears fruit in knowledge is also warmed by a content of feeling. To this, however, correspond the appropriate processes in the body, so that we understand how such thinking brings man to a unity of soul and body, to a harmonious interplay of his organizing system of forces."

If one views these realities, not abstractly, but in the living man in their world relationships, one then arrives at new forms of knowledge in *pathology* and *therapy*, in the *art of healing*.

The theory of the human organism, with its etheric formative forces and the other members of its being, demands for the art of healing also a thorough-going knowledge of the vegetable and mineral substances, of the remedies to be applied to the diseased human organism ; but not only of plants and minerals in relation to their physical structure but primarily in relation to their etheric structure—that is, to a knowledge of the etheric formative forces in these, either upbuilding or destroying, influencing the phenomena of life. Only a methodical knowledge of the etheric forces in plants, minerals, metals, springs, natural and artificial remedies can lead to a methodical application of these healing forces to the etheric organism of man, likewise accessible to knowledge, to a methodical therapy and to a comprehensive employment of all the healing forces of Nature. *In future the art of healing will rest upon a knowledge of the etheric in Nature and in man.*

When the human being recognizes that which belongs to soul and to spirit, how these express themselves vitally and harmoniously in the human organism, he recognizes also the element of soul and spirit and the physical in external Nature. For cosmos, earth, and man are built up according to the same will, through the same etheric forces, and of the same substances. Since the genesis of the element of soul and of spirit and of the physical in Nature became the genesis of man, so the human being who knows himself perceives at the end of his road the being of Nature.

After Nature has builded him, he builds and masters Nature, until human knowledge will embrace cosmos, earth, and man. Thus knowledge of the world becomes knowledge of man, and knowledge of man becomes knowledge of the world.

Only the fulfilment of the great command which since the Greek period has hovered before humanity throughout the centuries :

" Know thyself ! "

leads to the goal of the evolution of man and of the world.

A World Reflection

THE natural-scientific view of the world belonging to our time places at the beginning of our cosmic system the "primal nebula," at its end the "heat death." The cosmic system, evolved from the primal nebula—with its sun, zodiacal circle, planets, its human, animal, and mineral kingdoms—will merely be merged at the end of this evolution, according to this view, in the general heat death, the general dissolution and destruction. This world-conception was supposed to fulfil the task of describing the evolution of "Nature," but one quickly observes that the methods of research employed do not render possible a knowledge of *living* "Nature"; so that, during recent centuries, this research has become, more and more, for those who were honest and who were unwilling to delude themselves, a one-sided knowledge of the inanimate, of *dead* Nature. For one had to halt before the phenomena of life, in regard to which a great and upright man of learning previously quoted has said, "the investigator of to-day, with his conceptions which have thus far so wonderfully served him, has nothing to say."

In the knowledge of Nature, however, everything depends upon questions that we put to Nature. Nature answers rightly only where she is rightly questioned. But was not the entire questioning as done by the natural science of the past century false from the beginning? Was not the question so stated that the answer could never have led to a lifting of the veil which hides the living? Can the cosmic system, even if its evolution leads only from primal nebula to heat death, be comprehended even in fragments of its being through methods of thought attained and schooled in research in dead matter? In Chapter I we have shown, in reference to the theory of motion, that in this cosmic system there can be no motion-event from the simplest to the most complex whose ultimate cause does not lie in the will-impulse of a being who wills. The phenomenal world of our sense organs, the world of matter, is not a fixed, dead thing, but—viewed in the large—is at every moment of its existence in eternal motion, transformation, evolution, metamorphosis. Nothing stands still in this cosmic system; the face of the solid earth changes in relatively brief periods, just as essentially as the smallest units of substance, with their mutually whirling forces and substance nuclei, are in continuous inner motion. But this is Nature ! In her there is no substance that is not in inner and outer motion, no motion that is not ultimately will-impelled, nothing dead that is not a part of something living, nothing living and organic—however great it may be—that is not the bearer of that which possesses being and will. The second of the seven riddles of the great natural philosopher, Du Bois Reymond, regarding the origin of motion in the cosmos, signifies, indeed, for modern research the " limit of the knowledge of Nature " if this research wishes to know the evolution of substance from primal nebula to heat death without finding such means and methods as will include in this world-conception a knowledge of that which *was* before the primal nebula, *is* during the evolution of substance, and *will be* after this evolution—of that, namely, which maintains the moving, living, and ensouled world of substance constantly in motion and alive. *But the bridge to this must be formed by the knowledge of the etheric, the etheric formative forces in cosmos, earth, and man.*

In our day science begins to enter a stage of the process of knowledge where the arbitrary separation between the scientific and the religious, artificially set up by quantitative scientific research, cannot longer be permitted, because it will become a peril to humanity and to the world.

How, in the course of human evolution, did this separation between science and religion originate ? If one wishes to understand this in its ultimate depths, one must not consider human " knowledge " only according to its content, must not contrast knowledge and faith merely abstractly, but must really, from a very different point of view, put the far more essential question : In what way was knowledge " acquired " ? The evolution of human consciousness shows us two polarically contrasting methods by which men on earth have acquired " knowledge."

Novalis says in his " Fragments " : " Science in the large consists of the product of the memory sciences, the kinds of knowledge that are given, and rational sciences, or the kinds of knowledge that are *made.* These last are the work of man."

Let us supplement this course of thought.

Human capacity for knowledge also once fell into the " original sin " : that of sundering original unity. The first " knowledge " was given to man as revelation. Man received this knowledge from a spiritual world, which gave it to him. Whoever denies this deceives himself, or does not think through to the end. This knowledge which was given to man we would call—only to make it intelligible—" revealed science " ; for, when this knowledge came to man, he was passive, " feminine " ; he merely " received " ; the spiritual world " gave." What was thus given man set down in symbols, in rites, in cults and ceremonies, and in the great folk-myths. The first sort of knowledge became the content of religion.

But there came a time when it did not suffice for man to be merely passive in the act of knowing; merely the object of the activity of a spiritual outside of himself. He would subject to his will the acquisition of knowledge; would actively, as "masculine," share in creation and in performance, in the act of knowledge; he would lead himself in this, master himself, freely and self-sufficiently unite to his knowledge that which he desired and when he desired it. He strove to be free from "grace" and independent in the content and in the time of his knowing. We shall not here probe into the question whether he craved the possible or the impossible. That he did so crave sufficed, for thus originated the second great stream. This passed over from the feminine—receiving of knowledge to the masculine—cognitional act by mankind. It set up the human will as postulate in place of grace; it replaced revelation with observation and experiment; it laid down its knowledge, no longer in cult and symbols, but in books and scrolls. To-day this stream calls itself natural science. But in the zeal of his action man forgot that he had at first received his knowledge before his own will to knowledge was active; he forgot that his knowledge acquired by activity would never have been possible had not knowledge been given him beforehand without his own doing! Indeed, he disavowed this first "knowledge" as such although it was the daily and hourly instrument of his labour, and called it "faith" even where it had formerly been "knowledge." Thus the separation became intensified. The "revealed science" was preserved by religion; actively acquired natural science by the scientist.

The received knowledge man preserved at first at the seats of the ancient mysteries in India, Persia, Egypt, Greece and elsewhere. There was a three-fold meaning at the basis of the primeval cult ceremonies, rites, and symbols. A first significance, accessible immediately to any one who received this wisdom; a second significance intelligible only to the initiates; a third significance which was given by the ultimate, profoundest, true experience of wisdom. During the epoch of Greek culture, the practice began of disclosing to the folk—for example, in the mystery plays, and the great tragedies of the poets—a part of this wisdom. This was likewise the time when the event of the Mystery of Golgotha occurred, in which was performed the deed of the Christ; the time in which occurred the last great "revelations" to humanity. Since that time the religious tradition has, indeed, preserved the received knowledge; but later on, and especially after the fifteenth century, no essential content of revelation has been added to this. The physical element of man and the physical world in which this lives came over into the realm of natural science and its research ; the soul and its faith belonged to religion. But this separation was an arbitrary human act which fundamentally contradicted the realities of the cosmic evolution, and in time would have to be duly expiated.

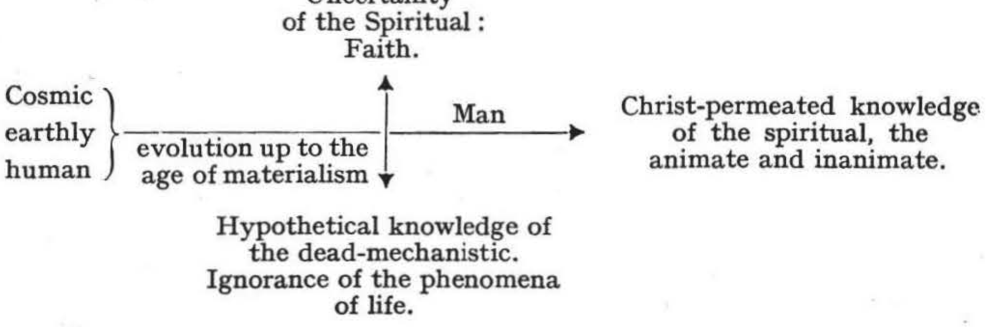
While the one stream which had received its knowledge only in passivity, in surrender, remained behind in the thinking evolution of man, the other stream, which desired to have its knowledge through activity in research and experimentation has forced its way beyond its own goal. Penetrating in research and mastering in constantly ascending measure the content of the physical world, the world of so-called "matter," this stream did not remain in the mere phenomena attainable to sense observation and experimentation, but thrust its thought beyond mere phenomena and constructed at the back of these phenomena a complicated hypothetical world of atomic and mechanistic theories, which are by no means given to man as a real content of experience. Mastery of man over " matter " is the tremendous service wrought by this stream of knowledge. But the exclusion of the so-called " subjective " and " qualitative " elements of the soul and the spirit of man—not to be severed by any violent act of thought—this was its great guilt. Those who live in our calamitous time begin—if they are not blind to reality—to feel and expiate this guilt.

The natural scientist and the atheist of this materialistic epoch have forgotten that man once received his knowledge without any act of his own as a gift from the spiritual worlds. If they would only take the trouble to trace human history back in logical fashion and to find out how knowledge came to man before he began to acquire it for himself by active observation and experimentation, they could in this way arrive at a " proof of God " and a real perception of a spiritual world, before which even the most sceptical brain must capitulate. The natural scientist of the present would often like to have, not only the content of his knowledge, but also the methods of thought used in his work, recognized as fixed in objective correctness ; and he is not generally pleased, therefore, to hear what is none the less true, that—*sub specie aeternitatis*—not only much of the present-day content, but also the methods of present-day occidental science are a mere episode, which is moving toward its abrupt close, in order that, after having achieved a vast amount, this epoch may be redeemed by a method of research that will include a knowledge and a world which those who concentrate their knowledge on inanimate Nature and the world of dead substance would rule out of the limits of knowledge or by arbitrary boundaries would wholly deny. And yet just there lie the eternal frontiers beyond which is knowledge of the phenomena of life.

Thus not only has the previous knowledge of a spiritual world been reduced during the past century to faith—that is, to an hypothesis—but also knowledge of the physical world, of matter, has been reduced by science to hypotheses. For the world of the "atom," of "vibrations," of "waves," etc., has never been perceived as such in its greatest and most essential part by any human eye or other sense organ. *Hypothesis here and hypothesis there! Only a knowledge whose range of experience includes the supersensible world can bring us a solution.*

But a research and a knowledge which passes over to the understanding of the phenomena of life and actual being in things—and thereby for the first time to a knowledge of things in themselves—is closely bound up with religion; indeed, for this a religious attitude is the primary requisite whether at the dissecting table or only in the pure act of cognition. It is a truth which must be uttered in our time that such a knowledge of the being of man, which includes the supersensible—*and just here lies the future task of our evolution*—would not have been possible but for the real event of the Mystery of Golgotha, without that which happened to the earth through the act of Christ. Only a Christ-permeated knowledge will find the means and the way to extend the knowledge of the being of man from the knowledge of dead substances to that of the living, of the spiritual. Natural science and revealed science join hands in the Christ-permeated knowledge of supersensible reality. Only by this road will man be able to pass over from hypothetical knowledge of substance and hypothetical faith in the reality of a spiritual world to an encompassing of the sensible and the supersensible in knowledge, for neither can ever really be understood apart from the other.

To an objective observer, both the previous evolution and the future task of humanity present themselves in the following diagram:


Uncertainty
of the Spiritual:
Faith.
Cosmic
earthly
human
evolution up to the
age of materialism
Man
Christ-permeated knowledge
of the spiritual, the
animate and inanimate.
Hypothetical knowledge of
the dead-mechanistic.
Ignorance of the phenomena
of life.

Even on the earth human cognition and knowledge have been metamorphosed in three different ways. The intellectual stream which has brought on the age of materialism is chiefly the work of the Occidental peoples. Their eyes were turned more and more away from the realities of the spirit—until they finally denied these—and were fixed upon those contents of experience which are associated with substance. Mechanistic thinking, with its mechanistic world conception, brought on the culture of the machine ; it has achieved a vast deal in this sphere, but in the most fundamental questions of the living, of the social, this intellectual current fails, and shows its complete bankruptcy in everything which is to be solved, not mechanically, but by the spirit, according to the facts of spiritual evolution.

At the other pole, in the Orient, there is dominant an intellectual current which has gone to the opposite extreme. Since it wishes still in the present to experience a spiritual teaching which was right for long past ages but is no longer suited to live in our day and is therefore false, it directs its thought-life too exclusively upon the spiritual worlds and too little upon the things of this earth, upon the problems of natural science and the mastery of matter. The Orient lives in a thought-world so utterly opposed to that of the Occident that a great conflict between these two mighty human groups in the near future is scarcely to be prevented. Every day we feel the first waves of a great struggle in which the Oriental and Occidental people will battle against one another, not only physically, but most of all mentally.

The men in the centre are hemmed in between these two currents flowing in from opposite extremes. This is a tragic fate only in case it does not lead us to activity, to action most of all in spiritual perception, for there lie the strategic points and the decisive factors even in physical affairs.

We must reconcile East and West—and we can do so—if we are not to be crushed by both, but we can achieve this only by uniting the mind of the East, directed toward the spirit, with that of the West, directed toward the physical, and lead the way to a new and higher spiritual knowledge, doing justice to the future task of united humanity on earth. Only the Christ-permeated knowledge, which embraces as a harmonious whole both religious and scientific truth, the physical and the spiritual, as these are not separated in reality, can solve this problem and ward off the threatening catastrophe from both West and East.

Such a knowledge will give to man again a different picture of the realities of the spiritual world from that seen by a materialistic age. There have been two currents in this epoch which have brought about a veiling of the spiritual and have cast a fog over man's knowledge of the supersensible. These have been, on the one side, the banal theology of " concessions," which makes before the time spirit of the materialistic age the bow imposed upon it by its own agnosticism where this surrender was not at all justified, and, on the other hand, a dying philosophy which has argued itself, through the jugglery of concepts alien to life, from a world of reality into a dead world of concepts.

Most unworthy of all for the proper placing of man within the world evolution has been the way in which this theology of concession, bowing to the time spirit, has sought to interpret the being of Jesus Christ. All its effort has been directed, as expressed in most so-called liberal theological treatises, to denude Christ, by its banal interpretations of the Gospels, of his cosmic and earthly mission, and to lower his dignity to that of " a good man from Nazareth," in order thus to render him as similar as possible to its own dear philistine personality of the twentieth century. This sort of theology even abandoned, as a concession to materialistic thinking, the belief in any being higher than that of man in the present age, who " has carried things so gloriously far " ; at most there is allowed to remain in this theology beside " the good man from Nazareth " an abstract conception of God, of whom men form either a fantastic anthropomorphic mental image or one nebulous and vague, or none at all.

By the side of this theology of concessions, the materialistic age produced a philosophy, especially as this appears in decadent post-Kantianism, which represents the spiritual world as consisting only of " ideal factual relationships " or moral " value concepts." But such a spiritual world is a truly lamentable combination of the still-born abstractions of an unproductive human understanding, bloodless shells of concepts, the only sort which can arise in the minds of men who are willing to believe their souls dependent upon the physical organism even in their highest activities. In order to leave to man a view of something superhuman, there is set up beside the " understanding " ascribed to man also an abstract " reason " which is supposed to be something existing purely spiritually, objectively, and *a priori*. In reality the spiritual world of the reason-concepts is distinguished from that of the understanding, as this is conceived by the post-Kantians, only as human yearning distinguishes an uncovered from a covered grave. Both are the result of the realm of thought void of the spirit, such as characterizes the age of materialism. Men write in text-books of many hundred pages systematic schemata of an abstract " ethics " which shall preach the " ideal fact relations " and moral " value concepts " for a humanity which in future will have neither time nor understanding nor need for admitting these collective works of a decadent realm of thought into their heads, menaced by the realities of the spiritual and the physical world. The coming generations will no longer be satisfied with these abstract systems of ethics and concepts of value and will no longer live with them. They need, in place of this decadent, unreal philosophy, a religiousness which does not enter into shells of concepts and *a priori* postulates ; a religiousness which leads again to a knowledge of the full reality of that spiritual world sharing throughout in the evolution of our cosmic system from primal nebula beyond heat death, which reveals to us the true meaning and deep significance of the evolution of Nature. Christ-permeated knowledge is the way to a conscious experience worthy of man of the physical and the supersensible world. The spiritual world of which we are here speaking is indeed supersensible but not supernatural ; that is, we can establish no union with it by means of our organs of sense as we can enter into a union with our physical environment, but it is a part of " Nature " in which we participate by means of our psychic and spiritual selves and also, in the most comprehensive sense, our bodily selves. Anthroposophy gives to the men of our time and to coming generations the possibility of extending their waking-conscious knowledge from the body of Nature, which the age of materialism would investigate, to the spiritual-soul part of Nature in its full reality.

Our age is cowardly in its view of spirit ; it sets up for itself, partly consciously and partly unconsciously, limits of knowledge, in order to be able to remain hidden behind these from what lies beyond. The chivalry of our age ought to be, not of the body, but of the spirit, of thought. A true chivalry of coming times will set itself to pass across the boundaries of habit and cowardice, will boldly mount up to supersensible knowledge.

Earlier great epochs held the ideal of being able to lead man to divine humanity ; but the age of materialism has wished to reduce the significance of the divine man Christ to the philistinism of the twentieth century, and to replace the realities of the divine spiritual worlds by a philosophical system of concepts. The rising new generations will abandon this road.

The great philosopher Vladimir Solovieff, who kept himself entirely free from this dying decadent philosophy of our age and thus remained a most significant philosophical messenger of a true Christianity, says in explaining the essential difference between God the Father and God the Son, in his " Vorlesungen über das Gottesmenschentum "* :—" If we investigate the whole content of the teaching of Christ which we find in the Gospels, then the new, the specifically differentiating, element in this teaching as compared with all other religious teachings will be the teaching of Christ about himself, the reference to himself as the living Truth become flesh : ' I am the Way, the Truth, and the Life. Whosoever believeth on me shall have eternal life.'

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* " Lectures concerning the Divine Humanity."

" If we thus seek for the characteristic content of Christianity in what Christ himself taught, we must admit that this content refers to Christ himself.

" What shall we think, what comes to our mind, in the names of Christ, which are said to be Life and Truth ?

" God, who is from eternity, eternally realizes himself in realizing his own content—that is, in realizing the All. This All, in contrast to the God who essentially exists as an absolute oneness, is the multiplicity, but a multiplicity as content of the unity, a multiplicity controlled by the oneness and brought to a unity.

" A multiplicity reduced to unity is a whole. The real whole is a living organism. God, as the one who is, who realizes his content as unity and holds the multiplicity enclosed within Himself, is a living organism.

" From what has been said above we see the All, as content of the absolute principle, cannot be simply a sum of individual undifferentiated beings, but that each of these beings represents its own special idea, which comes to expression through a harmonious relation to all the rest, and that each individual is thus in itself a necessary organ for the whole.

" On this ground we may say also that the All as content of the Absolute—or that God, who realizes his content—is an organism.

" There is no reason for limiting the concept *organism* to material organisms. We can speak of a spiritual organism, of a folk-organism, of an organism of all humanity and therefore also of a divine organism. The concept organism itself does not exclude such an extension of use, since we call everything an organism which consists of a multiplicity of elements that are not related indifferently to the whole and to each other, but are necessary to the whole and to one another, and to the extent, indeed, that each represents its own content and therefore has its own significance for the others."

" The elements of the God-organism themselves exhaust the fullness of its existence and in this sense this organism is universal. This fact, however, not only does not prevent this universal organism from being absolutely individual but by logical necessity requires such an individuality. . . ."

" In every organism we necessarily have two unities : on the one hand, the unity of the working principle which comprises the multiplicity of the elements within itself, and on the other hand this multiplicity reduced to unity as the determinate copy of this principle. We thus have a creative unity and a created unity, or a unity as principle in itself and a unity as a manifestation."

"In the divine organism of Christ is manifested the working and unifying principle which in itself brings the unity of the absolute being to expression, *the Word, or the Logos.*"

To these words of the great christian philosopher, Rudolf Steiner adds the following:

"In Solovieff's soul there are clearly two experiences side by side: the experience of God the Father in the existence of Nature and man and that of God the Son, Christ, as the Power which removes the human soul from the bondage of Nature's existence and incorporates it for the first time in the true spiritual existence.

"Middle European present-day theologians are no longer in the position to distinguish these two experiences. Their souls reach only the experience of the Father. From the Gospels they gain only the conviction that Jesus the Christ was the human herald of God the Father. For Solovieff the Son in his Godhead stands beside the Father. Man, like all beings, belongs to Nature. Nature in all her beings is the product of the divine. One can permeate oneself with this thought. Then one looks to God the Father. But one can also feel that man must not remain a part of Nature. Man must raise himself above Nature. Nature becomes sinful in him if he does not rise above her. When we follow the way of the soul in this direction, we arrive at the regions where we find in the Gospels the revelation of God the Son."

The Evangelist John expresses this: "And the Word became flesh and dwelt among us, and we beheld his glory, glory as of the only begotten Son of the Father, full of grace and truth."

The descent of Christ upon the earth signifies, therefore, in truth a cosmic event, sets the evolution of the world-organism comprised within God the Father upon an entirely new course; gives a new sense to it; a deed which for the world of involution represents the releasing, the central point from which the true ascent can first begin. Modern knowledge of the world speaks of "primal nebula" and "heat death" of the world organism, of the beginning and the end of the world. It forgets the middle of the world, which was fixed by the event of the Mystery of Golgotha, through the appearance of Christ in the terrestrial world. Only the Christ-permeated knowledge of coming ages will be able to understand the world, because it will be able to understand, beside the world-beginning and the world-end, also the realities which were begun by the middle of the world.

Just as the knowledge of the etheric will enable us to understand and to copy the living world organism, instead of the cosmic corpse set forth by our present world-conception, so also only a union of religion with science in man will lead us to a mastery of the living, after we have till now been able to master only the dead. Only so will man be able to lay hold with shaping power upon the cosmic evolution and impress his stamp, not only on the dead, on substance, but also on the spiritual, unite his being with this, give worth to his co-operation. Only so will he creatively produce realities which will last beyond the " heat death " of substance, beyond the end of the world. Christ-permeated knowledge will enable man to embrace in knowledge both the sensible and the supersensible, so that the Christ-permeated knowing man shall become " the living garment of the Godhead," and the words which Christ spoke at the middle point of world history shall be true: " Heaven and earth shall pass away, but my words shall never pass away."

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